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PROJECTING THE RESULTS OF STATE SMOKING BAN INITIATIVES USING CARTOGRAPHIC ANALYSIS

Donna Arlene Gilbreath
University of Kentucky, donnag@uky.edu

ABSTRACT OF THESIS

PROJECTING THE RESULTS OF STATE SMOKING BAN INITIATIVES USING CARTOGRAPHIC ANALYSIS

Because tobacco smoking causes 430,000 U.S. deaths annually, wide-reaching smoking bans are needed. Bans reduce cigarette consumption, encourage cessation, protect nonsmokers from second-hand smoke, and promote an attitude that smoking is undesirable. Therefore, bans may prevent future generations from suffering many smoking-related health problems. The federal government has not implemented wide-reaching smoking bans so it falls on individual states, counties, or communities to devise appropriate smoking policy. To date, smoking policy has been determined by legislators, who may have conflicts that prevent them from acting in the public's best interest. However, this method of implementing smoking policy may be changing. In 2005, Washington residents voted by ballot initiative to strengthen existing state smoking regulations. In 2006, Arizona, Nevada, and Ohio residents voted by ballot initiatives to implement strict statewide smoking bans. This research presents a way to predict how residents of other states might vote if given the opportunity. Two research hypotheses are tested and accepted: a positive relationship between favorable votes and urbanness, and a preference favoring smoking bans where smoking regulations already exist. Finally, a projection is made that a smoking ban vote in Kentucky would yield favorable results, and a map showing projected county votes is provided.

KEYWORDS: medical geography, smoking ban, urban, outcome prediction, ballot initiative

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By

Donna Arlene Gilbreath

_____
Dr. Stanley D. Brunn, Co-Director of Thesis

_____
Dr. Alice Turkington, Co-Director of Thesis

_____
Dr. Matthew Zook, Co-Director of Thesis

_____
Dr. Richard Schein, Director of Graduate Studies

_____
Date

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THESIS

Donna Arlene Gilbreath

The Graduate School

University of Kentucky

2007

PROJECTING THE RESULTS OF STATE SMOKING BAN INITIATIVES USING CARTOGRAPHIC ANALYSIS

THESIS

This thesis submitted in partial fulfillment of the
requirements for the degree of Master of Arts in the
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at the University of Kentucky

By

Donna Arlene Gilbreath

Lexington, Kentucky

Co-Directors: Dr. Stanley D. Brunn, Professor of Geography
and Dr. Alice Turkington, Professor of Geography
and Dr. Matthew Zook, Professor of Geography

Lexington, Kentucky

2007

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CHAPTER 1: INTRODUCTION

Medical Geography Background and Literature Review

Geography has long been concerned with medical and public health issues. A seminal work is John Snow's classic epidemiological study which traced cholera to the Broad Street public water pump in London in the 1800s (Snow 1849). Another classic is Daniel Defoe's study of "Black Death" in London, which was traced to environmentally displaced rats and was transmitted to humans through flea bites (Defoe 1969).

In more recent years, the interests of medical geographers have widened. Pyle (1976) discusses these changes in scope. According to Pyle, in the 1930s medical geography was concerned with identifying diseases. He mentions E.B. McKinley's work as an example of medical geographic studies during this era. McKinley published "Geography of Disease" in 1935, which identified 80 tropical diseases and 32 temperate climate diseases. In the 1950s, Jacques May developed the concept of disease ecology, studying environment as inorganic (climate), organic (interdependence among various plants and animals), and socio-cultural (aspects of human behavior). By the 1970s, there were five relevant approaches to the spatial study of disease: environmental, genetic, epidemiological, behavioral, and socioeconomic. Later these approaches became collectively considered studies of disease ecology, and the broad category of health care services was added as a geographic approach. Geographic methods have also been developed: cartography and geographic information systems (to show diffusion, for example), trend surface analysis (to locate clusters), regression path analysis (to identify intersecting paths), statistics (to prove variable correlation), and both retrospective (after-the-fact) and prospective (pre-planned) studies.

Health Care Services

Health care delivery is concerned with matters such as availability of physicians and location of health care facilities (Morrill, Earickson et al. 1970; Lankford 1974). Research in this approach also focuses on the changing needs of health care and use of health care services. Studies of mental health and women's health may also be included (Gesler 2005).

Phillips (1994) posited that health care needs change as economic development improves, not only at the national level, but also at the community level. Some examples: advances in medical services have resulted in fewer deaths from infectious diseases, but such advances also enable people to age to the point that chronic diseases begin; improvements in standards of living result in less malnutrition; higher incomes enable people to take better care of themselves, but often also results in stress (causing hypertension) and sedentary lifestyle (which contributes to obesity).

Epidemiology

While medical geographers interested in epidemiology remain interested in traditional diseases such as influenza (Pyle 1984), "new" diseases have arisen, providing new needs for epidemiological research. Some of these "new" diseases include AIDS (Shannon and Pyle 1989), Bovine Spongiform Encephalopathy (Hinchliffe 2001), and Severe Acute Respiratory Syndrome (SARS) (Shannon and Willoughby 2004).

Effects of Environment on Disease

Geographers have also studied environmental factors that may have given rise to some of these new diseases. These studies consider natural environmental features, such as climate or vegetation, as well as human-made environments including poor water quality or substandard housing (Rao and Kalkstein 1990; Gatrell 1997).

Haggett (1994) notes that in 1917 the American Public Health Association recognized only 38 communicable diseases (viruses), whereas in 1994 that number had grown to 280. Haggett enumerates some possible explanations for these "new" viruses. One explanation is that some viruses were overlooked—either they existed, but had not been recognized or the illnesses they caused had mistakenly been attributed to other sources (Marburg, an African tropical disease for example). Another explanation is that viruses can change genetically to cause slightly different illnesses (influenza), and they can change significantly and jump the species barrier (HIV from African monkeys). Other new viruses are simply viruses that have been transported to new locations through migration (smallpox) or travel (Avian Flu). Also, urbanization can increase opportunities for illnesses from poor sanitation. Furthermore, deforestation and reforestation can

change the environment sufficiently to disrupt ecosystems, causing increased number of vector insects, for example (Lyme Disease from ticks). The scenario is similar for changes in water supply from dam construction or irrigation. These changes can provide breeding grounds for mosquitoes that carry malaria and other viruses.

Socioeconomic Factors and Health

Gatrell (1997) states that just as a relationship between geographic environment and health exists, so too does a relationship between social environment and health. He exemplifies a positive relationship between relative income and life expectancy, pointing out that there is "reduced life expectancy for those with lower incomes, in more manual occupations, and in minority ethnic groups" (p. 142). Moreover, variation within absolute environments affects health. He uses as an example a study comparing income and life expectancy in Japan and the United Kingdom in the 1970s. The difference between low and high incomes decreased in Japan and increased in the United Kingdom. Over the same time period, life expectancy increased at a faster rate in Japan than in the United Kingdom (Wilkinson 1993). This was also evidenced by a study of income and health in the United States that compared death rate and income for the 50 states (Kaplan, Pamuk et al. 1996). Gatrell extends these studies to show that health is affected by variation *between* as well as within geographic areas. Hence, when poverty is higher in an area than in areas surrounding it, health will decline according to the amount of difference. In a study of income and all-cause mortality, Gatrell finds that 40 percent of mortality can be explained by greater income variation between a place and its neighbors. One possible explanation for this is psychological: people in deprived areas have a lower sense of control relative to those around them.

Cultural and Behavioral Factors and Health

Cultural and behavioral studies include research on diet and nutrition, violence, and drug and alcohol abuse. My interest, and the topic of this paper, is cigarette smoking, a behavioral factor that contributes to poor health. Smoking is considered both a human-made "epidemic" and a public health hazard. The following articles provide some specific background in this regard.

Nathanson (1996) posits that both government intervention and public participation (social activists) are essential in prompting public health policy. Important elements for policy to be developed include convincing the public that significant risk exists, that causation exists, and that the public is a potential victim. In the U.S., the Surgeon General's 1964 report legitimized the notion that smoking causes cancer. Subsequent annual reports kept the issue in the forefront of the American public. In addition, grassroots activists like GASP (Group Against Smokers' Pollution) acted to convince non-smokers of their right to clean air. A 1986 report of the Surgeon General implicated "involuntary" (second-hand) smoking as a cause of disease in non-smokers, and social movements picked up that theme as well, to inform the public. In absence of anti-smoking social movements (in France for example), smoking remains viewed as an individual behavior rather than either a political or medical problem. Smoking in France is sometimes considered an indulgence like a good wine, to be enjoyed in moderation. Subsequently, smoking-related deaths and illnesses are higher in France than in the U.S.

Ross and Taylor (1998) consider relationships between attitudes toward smoking and social environment for 11 paired communities (one for intervention, one for comparison) in the U.S. National Cancer Institute's Community Intervention Trial for Smoking Cessation (COMMIT). This large trial involved 2 million participants and was conducted from 1989-1993. The goals of COMMIT were to increase smoking cessation as well as the attitude that smoking is a public health problem in the intervention communities [see Lynn WR and Thompson B (1995) Community Intervention Trial for Smoking Cessation: Description and Evaluation Plan. In Community-Based Interventions for Smokers: the COMMIT Field Experience. NIH Publication No. 95-4028]. A statistically significant increase in cessation was achieved for light smokers and there was a modest change in attitude about smoking as a public health problem among heavy smokers. COMMIT measured seven factors, four related to smoking as a public health problem (SPHP) and three related to social norms and values about smoking (NVS). The SPHP factors included: smoking control in public places, legislative control, smoking control in health settings, and smoking control in schools. The NVS factors were belief in the harmfulness of smoking, social actions concerning smoking, and the perceived risks of second-hand smoke. Low scores indicate anti-smoking attitudes and high scores

indicate pro-smoking attitudes. The authors provide graphs of the SPHP and NVS scores separately to illustrate changes in the variables within places. For example, SPHP in Raleigh, NC shifted toward anti-smoking sentiment after the intervention. These graphs demonstrate conclusions about the success of communities with intervention versus those without. The authors concluded that the communities in North Carolina were the most pro-smoking, presumably because the state is economically dependent on tobacco. This finding is less so in Raleigh than in Greensboro, because Raleigh is the capital, is more cosmopolitan, and has a comparatively more diversified economy. The Iowa communities were next high on the pro-smoking scale. This was suspected because of the state's preemptive smoking legislation and lack of enforcement for the legislation that existed. Differences in socioeconomic levels in the two Washington communities led to dissimilarities between them. The New Jersey communities showed strong beliefs toward the seriousness of smoking, presumably due to a combination of high smoking prevalence, high prevalence of drug abuse, and the high level of anti-smoking activity. New Mexico had the lowest smoking prevalence and a high anti-smoking attitude, despite lenient legislation. This position was attributed to a high percentage of white collar employment and large Hispanic population. Over all, the authors surmised that "the mix of social, legislative and cultural forces in different places affects attitudes towards smoking and likely readiness for public health activities in the form of policy or education" (p. 716). If this assessment is correct, there is no uniform way to deduce whether a place is ready to consider smoking legislation; rather, one would need to evaluate a matrix of each individual community's economic, political, and social aspects to make that determination.

I plotted the two variables against each other, with SPHP on the x-axis and NVS on the y-axis, which allowed me to draw conclusions about geographic location and the sentiment toward smoking after the intervention was completed. I found:

a) North Carolina cities ranked highest as pro-smoking places (that is, high for both variables);
b) Bellingham, WA ranked highest for anti-smoking;
c) Paterson and Trenton, NJ have high NVS with low SPHP; and

d) Washington State, Oregon, and New York ranked lowest on the NVS scale.

Moon and Barnett (2003) discuss their research on smoking prevalence in New Zealand. They note that there has been little research on the geography of smoking in New Zealand. Among factors they reported, just under 25 percent of all adults smoke, consisting of 26.4 percent of males and 23.5 percent of females. Younger people are more likely to smoke than elderly. People who live in the poorest areas of New Zealand are more than two times as likely to smoke than those who live in richer areas. Ethnicity is related to smoking: 45.5 percent of Maori adults, 27.7 percent of Pacific Peoples, 23.2 percent of Pakeha, and 10.1 percent of others smoke. The statistics on ethnicity are compounded, however, by deprivation, as many Maori adults, they note, are poor. The purpose of Moon and Barnett's research was to determine the extent that deprivation versus ethnicity effects smoking prevalence in New Zealand. They examine 1996 census data (which provides data on smoking) and employ a multilevel statistical modeling approach to separate these factors. Furthermore, they consider smoking prevalence at the micro (meshblock), meso (census area units), and macro (territorial local authority units) scale. In this way, they are also able to factor in urban status. Moon and Barnett conclude that the average percentage of smokers in New Zealand is actually 23.7 percent, which is comparable with the percentage reported by the Census (above). Likewise, they find less smoking among elderly concentrations and more in deprived areas. They also determined that in areas where there is great ethnic mix, the Maori within the mix are more likely to smoke. In addition, they find a lower percentage of smokers in urban areas, such that higher levels of smoking are a rural phenomenon. Finally, while the highest rates of smoking are in the North Island, they are not as high as would be expected given their socio-demographic composition.

Greathouse, Hahn et al. (2005) explain how key elements came together to present an opportunity for Fayette County, Kentucky, in the heart of tobacco country, to implement a countywide smoke-free policy. A "multiple streams" approach was used to identify those key elements. The three "streams" were: (1) problems presented to policymakers, (2) policies generated by experts, and (3) politics, such as tobacco industry involvement, pressure group campaigns, and legislative turnover. In Kentucky, tobacco is

important—it is grown in 117 of 120 counties, with Fayette County ranking third in terms of tobacco production. At 32.6 percent (in 2002), Kentucky had the highest percentage of smokers in the U.S. and ranked 49th in smoke-free workplaces. However, certain indicators showed that the time was right for political change in regard to smoking in Fayette County. For example, compared with Kentucky as a whole, Fayette County had a lower percentage of smokers, greater proportion of smoke-free restaurants, more educated population, and lower poverty rate.

In summary, many elements effect smoking prevalence, including demographic factors such as sex, age, and ethnicity; legislative factors including government intervention (elimination of preemptive smoking legislation, for example) and economic dependence on tobacco; socio-economic factors including poverty, income, and education; and socio-cultural factors such as work by anti-smoking activists and attitudes toward smoking. My research will look at a couple other elements. One is living in urban (capital, cosmopolitan, diversified) versus rural areas. Moon and Barnett (2003) mention this factor in their research on smoking in New Zealand. The other is exposure to non-smoking policy. This is hinted at by Ross and Taylor (1995) in their COMMIT research.

Research Project Overview

Recent events, such as the 1990s "tobacco wars" (legal battles against the tobacco industry) and an "outbreak" of local smoking bans have provoked interest in smoking and smoking bans as a topic that is both timely and worthy of special focus in many disciplines: public health studies, medicine, policy studies, and sociology to name a few. Geographic studies can add to the literature by addressing some questions a geographer might ask about smoking:

a) Where are most smoking-related deaths?
b) What areas have the highest and lowest percentages of smokers, and how are those places different?
c) How has smoking consumption changed over time?
d) How does smoking affect prevalence of cancer or cardiovascular disease?
e) How could a statewide smoking ban affect the economy in a tobacco-dependent state?

f) Are states that have many local bans more likely to pass statewide smoking laws than states that have few local bans?
g) Are rural or urban places more likely to have smoking bans?

As noted above, the focus of my study is associating smoking bans with "urbanness" and existing regulations, and my goal is to develop a methodology that will enable prediction of potential statewide smoking ban votes. I draw upon data from three states that passed smoking bans by ballot measure in 2006: Arizona, Nevada, and Ohio.

Two initiatives were presented in Arizona: Propositions 201 and 206. Proposition 201 called for a smoking ban in all public places, and was promoted by the American Lung Association, the American Heart Association, and the American Cancer Association. Proposition 206 would have exempted bars and alcohol-dependent businesses such as bowling alleys and pool halls (Crawford 2006).

The initiatives in Nevada were The Clean Indoor Air Act and the Secondhand Smoke Act. The Clean Indoor Air Act was the more restrictive and was supported by the American Cancer Society, the American Heart Association, and the Nevada State Medical Association. It would ban smoking in nearly all indoor public places, including grocery and convenience stores, indoor areas of restaurants, retail stores, and movie theaters, but would exempt casinos. The Secondhand Smoke Act, also referred to as Responsibly Protect Nevadans from Secondhand Smoke, was created in response and was funded by casino and bar owners, who believed The Clean Indoor Air Act would be harmful for tourism. The Secondhand Smoke Act would have restricted smoking in restaurants to areas where children are not allowed. It would also have banned smoking in schools, retail stores, and movie theaters, but would have allowed smoking in grocery and convenience stores in areas where gaming machines are located.

In Ohio, the ballot initiatives were Issue 5 (Smoke Free Ohio) and Issue 4 (Smoke Less Ohio). Smoke Free Ohio would prohibit smoking in all indoor public places with few exceptions, and was supported by the American Lung Association and the American Cancer Society. Smoke Less Ohio would exempt bars, restaurants, and a few other places. It was supported by the tobacco industry and, surprisingly, hospitals.

Initial examination of the vote data from these three study states (Arizona, Nevada, and Ohio) led me to formulate the hypothesis that there is a *positive relationship*

between large cities and percent yes votes. Cartographic analysis will be used to test this hypothesis. Specifically, I will prepare a choropleth map for each state, showing the percentage of favorable votes in each county overlaid with proportional point symbols showing the location and population of large cities. If such a relationship exists, I will perform further analyses using a county-level measure of urbanness devised by the U.S. Census Bureau (percent urban) to assess *a positive relationship between the percentage of a county's population that lives in an urban area and the percentage of a county's population that votes favorably on a smoking ban*.

To assess this question, I will construct scatter plots showing each county's percentage of favorable votes on the x-axis and the percent of each county that is urban on the y-axis. I will visually and statistically examine a composite scatter plot to determine whether a positive, negative, or no relationship exists between the two variables. In addition, I will examine individual scatter plots to discern if each state's contribution is consistent. Finally, I will perform simple correlation analyses to provide a statistical test of the hypothesis.

Pyle (1984) used the above method to examine how the national inoculation program affected the spread of Swine Flu in the 1976-1977 epidemic. Pyle constructed four graduated circles maps of the U.S. to show diffusion over time, and also constructed an x-y graph to relate distribution to distance from origin (where x is miles from the origin and y is rate of infection). He plotted the number of cases (y) for each month (x) for key cities to show what month the peak outbreak occurred. Pyle constructed four choropleth maps to show the cumulative percentage of the population that was inoculated, by month. He used an x-y graph to show the number of inoculations (y axis with log scale) and number of susceptible persons (x-axis by rank of city population for 0-100 most populous places). Finally, he showed cyclical pattern of deaths 1973-1978 with a line graph of deaths (y) and month (x). Pyle concluded that "special emphasis should be placed upon large central city areas as well as regions of the country where traditionally conservative attitudes place too much emphasis on the abilities of the private sector to deliver prevention mechanisms during such a crisis" (p. 292). Furthermore, the populations that are most susceptible and the populations that are nearest potential epicenters should be targeted early.

Based on the scatter plots of data from my study states, I will compute a "likelihood of voting yes" percentage for each 10 percent interval on the x-axis (county percent urban)—for example, counties 0-10 percent urban will likely vote yes *x* percent of the time. Thus, I will arrive at a means to project smoking ban votes based on "urbanness."

My second hypothesis is one of propinquity, that is, whether the *presence of a local smoking ban assures voter support*. If favorable votes are "guaranteed" in counties that have existing smoking regulations, the likelihood percentage that I calculate (above) for those counties can be changed to reflect a guaranteed yes vote. This notion stems from a 2005 vote in Washington in which residents were asked to vote on a proposition to strengthen the 1985 Clean Indoor Air Act. The existing Act requires all workplaces to be 100 percent smoke-free. The initiative to be decided (Initiative Measure No. 901):

> "will expand the definition of 'public place' to include a reasonable distance around each public facility, defined as 25 feet from entrances, exits, windows that open, and ventilation intakes that serve an enclosed area where smoking is prohibited. The definition of 'public place' includes private residences used to provide licensed childcare, foster care, adult care, or similar social services. The definition also includes bars, taverns, bowling centers, skating rinks, casinos, and at least 75 percent of the sleeping quarters within a hotel or motel and rented to guests." (Washington State Department of Health's Tobacco Prevention and Control Program 2006)

The result was a unanimous, resounding "yes."

To explore this hypothesis, I will compare the 2006 vote results from Arizona, Nevada, and Ohio with a list of places that had smoking bans before the 2006 votes (available from the American Lung Association at http://slati.lungusa.org/). From these results I will be able to compute the likelihood of a favorable vote for counties that already have smoking regulations.

Finally, to project the voting outcome for Kentucky counties I will multiply each Kentucky county's population by its percent likelihood of a favorable vote to arrive at an estimated number of people in each county that will likely vote "yes" to a potential smoking ban initiative (assuming that every person in the county votes). Then I will identify counties that contain cities with greater than the established city threshold for

population size and change the percentages for these counties to 100 percent (because I will have established that counties that have cities with over *n* people vote "yes"). Then I identify counties in which a smoking ban already exists and change these counties to their percent likelihood of a yes vote as calculated above. Finally, totaling the number of likely yes votes and dividing by the total population will yield the likelihood of Kentucky passing a statewide smoking ban by ballot vote.

Contributions

By performing this research, I hope to develop a way to project whether residents of a state (Kentucky, as a case study) will likely vote favorably on a referendum or initiative to implement a statewide smoking ban. Determining the likelihood of favorable votes is useful because it shows the general opinion of public smoking. With this knowledge, smoking policy activists can rally in areas where opinion is negative toward smoking bans, and can move to activate policy where public opinion is favorable. In so doing, smoking policy activists can further their cause, viz., to reduce smoking in order to improve the health of the general public.

Chapter Summary

This chapter has reviewed examples of major topics medical geographers have studied, including health care services, epidemiology, and environmental, socioeconomic, and cultural/behavioral factors that affect disease and health. It has also provided a review of literature pertinent to geography and smoking, and has introduced smoking and smoking bans as valid topics for geographic inquiry. The latter part of the chapter provides an overview of the research performed in this study, including the basis on which this research is grounded and the methodology that is used.

In Chapter 2, a history of smoking is presented, beginning with introduction of tobacco to the U.S., continuing with factors that led to the increasing popularity of cigarettes, to obstacles that blocked enforcement of legislation, and concluding with a discussion of lawsuits that marked the downfall of the tobacco industry. In Chapter 3, I will review the health hazards related to smoking. I will also provide a map that illustrates the prevalence of smoking in the U.S. In addition, I provide a summary of

some key websites that provide information about smoking-related issues. In Chapter 4, I will relay information regarding federal, state, and local laws that restrict or ban smoking. I provide maps that illustrate where smoke-free laws exist and where state laws preempt local laws. I describe the increasing number of cities with smoke-free regulations. I end the chapter with the suggestion that smoking laws be voted upon by the public rather than by legislators. Chapter 5 details this cartographic project. Two hypotheses are presented and the process leading to their acceptance is described. In Chapter 6 I project an outcome for a potential ballot vote on a statewide smoking ban in Kentucky. Chapter 7 presents the conclusions and limitations of this study and describes its contributions to medical geography.

CHAPTER 2: HISTORY OF SMOKING IN THE U.S.

This chapter provides a review of pertinent literature regarding the history of smoking in the U.S. to provide the reader an understanding of how tobacco smoking became a widespread, socially engrained norm. It also describes the reasons that smoking remains commonplace long after it was determined to be a personal health hazard *and* a public health hazard. These reasons include obstacles created by the tobacco industry and smokers themselves, which had to be overcome before legislation restricting smoking could be passed. The lawsuits that comprise the "tobacco wars" of the 1990s will also be discussed. These legal trials proved industry liability and led to the downfall of the tobacco industry. The final discussion addresses efforts toward tobacco control, viz., what has been done and directions for the future.

Discovery and Diffusion of Tobacco

Ravenholt (2006) explains that tobacco was introduced to Christopher Columbus in Cuba in 1492 and that the tobacco weed was named for the pipes it was smoked in on the island of Santo Domingo. Tobacco was shipped to Spain, France, and England, and by 1600 it was used by royalty and the wealthy across Europe. By 1700 it was used in Africa, India, and the Orient as well. In these early years, chewing was the most common form of tobacco use, however tobacco was smoked and snuffed as well (snuffing is sniffing tobacco dust through a tube). Tobacco was also used for its supposed curative power. It was used as a plaster, an ointment, a wash, or drops, to cure nearly any ailment whether physical or mental. Non-medical use of tobacco was controversial. King James I found tobacco smoking loathsome and dangerous and he attempted to dissuade its use in England. Ironically, tobacco was the main crop of Jamestown, his namesake colony in the New World. Furthermore, King James taxed tobacco imports so his country could profit from the tobacco trade even though he disapproved of it.

Popularization of Tobacco Use

According to Regulating Tobacco Use: A Report of the Surgeon General (U.S. Department of Health and Human Services 2000), the term "cigarette," which means

small cigar, was coined in 1840. Popularity of the cigarette in the U.S. increased during the Civil War (1861-1865), as medics used cigarettes to ease pain and soldiers used them to relieve boredom and tension (Ravenholt 2006) (Figure 2.1). When soldiers returned home, they often brought the habit of smoking with them. Toward the end of the Civil War, the U.S. imposed a federal tax on cigarette purchases in order for the government to reap a profit from their sales (Ravenholt 2006). The habit of smoking increased dramatically after 1881, when James Albert Bonsack's cigarette rolling machine was patented. The machine cut the cost of cigarette production by one-sixth. James Buchanan Duke purchased several machines and merged his cigarette company with several competitors to form the American Tobacco Company in 1890. Thereafter, with the handiness of pre-rolled cigarettes, consumption increased for nearly the next 75 years.

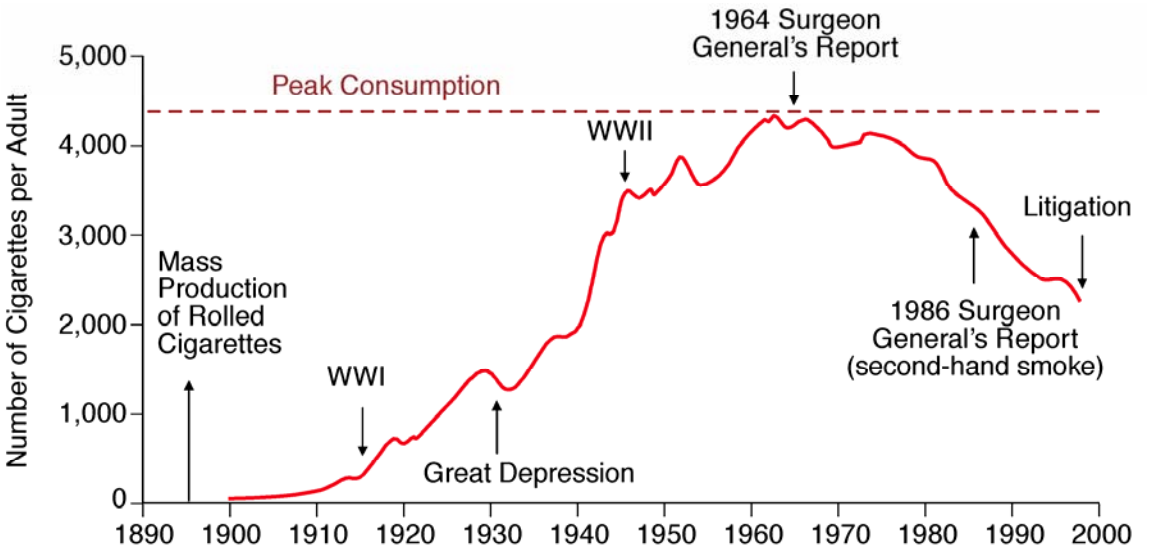

Figure 2.1: Cigarette consumption (Pampel 2004).

Advertising had a tremendous influence on the popularity of cigarette smoking. In the early 1890s, the large tobacco companies of Philip Morris, RJ Reynolds, Liggett and Myers, and Lorillard were formed. Brands, including Chesterfield and Camel were advertised as manly. Soon Virginia Slims, Eve and other brands were advertised to target women. As occurred during the Civil War, first WWI and then WWII laid claim to addiction of a multitude of soldiers who brought the habit back to the U.S. when they returned. It is interesting to note that the government was providing free cigarettes to

soldiers in their rations during both these wars (Ravenholt 2006). During WWII the military consumed one-fourth of all cigarettes produced in the U.S. causing a cigarette shortage.

As were other products, cigarettes were first advertised by posters placed in storefront windows and newspapers. Radio, then theater and television later provided advertising venues that reached massive numbers of people and compounded the publics' exposure to cigarette advertisements (Ravenholt 2006). Cigarettes and smoking became ubiquitous as actors and actresses smoked first in the theater then on television (U.S. Department of Health and Human Services 2000).

Tobacco: Harmful?

Not all published material about cigarettes was positive, however. Articles that relayed health concerns associated with smoking began appearing in 1920s popular magazines such as *Readers' Digest* and *Science.* These magazines published articles that described how tobacco injures the human body and shortens life expectancy (U.S. Department of Health and Human Services 2000; Borio 2001). Medical studies in the 1950s convinced the American Cancer Society, the Consumer's Union, and Surgeon General Leroy Burney that smoking is a cause of lung cancer and coronary artery disease (Wynder and Graham 1950; Doll and Hill 1952; Levin 1953). These studies and articles frightened consumers, lowering purchases and prompting use of filter tips. At the same time, however, the American Medical Association challenged the validity of these medical studies, claiming a lack of authoritative evidence.

Controversy over the harms of smoking continued, and in 1962, the Royal College of Physicians (in England) reported that smoking causes lung cancer. In response, President John F. Kennedy commissioned Surgeon General Luther Terry to form a committee to assess the current knowledge on smoking and health to settle the issue (U.S. Department of Health and Human Services 2000; Ravenholt 2006). The resulting report was the single most important work regarding the history of smoking: the 1964 Surgeon General's report entitled *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service* (hereinafter, the 1964 Surgeon General's Report). This report confirmed what many had suspected—that

smoking causes lung cancer. The Surgeon General's report and conclusions resulted in several actions. It would be fair to say this report had "gravitas."

Kagan and Nelson (2001) write about these actions. The 1964 Surgeon General's Report prompted Congress to pass the Federal Cigarette Labeling and Advertising Act in 1965, which required a warning statement on cigarette packages: "Caution: Cigarette Smoking May Be Hazardous To Your Health." Unfortunately, this Congressional act preempted stronger warning by other levels of government. The report also prompted the Federal Communications Commission to request in 1967 that the "Fairness Doctrine" apply to broadcast cigarette advertising. As a result, radio and television stations had to provide airtime for antismoking messages equal to the airtime allotted to smoking advertisements. This was short-lived, however, because in 1969, Congress passed the Public Health Cigarette Smoking Act, which banned all broadcast advertisements for cigarettes and again preempted further state action. The year of the report's publication (1964) also marked the first decline in per capita cigarette consumption in the history of the U.S. (Pampel 2004).

Obstacles to Legislation

Even after conclusive evidence that cigarette smoking causes cancer and other illnesses, many obstacles had to be overcome before legislation to control cigarette consumption could pass. The first obstacle was simply that the general public had not been convinced that smoking was harmful. The second was that even after smokers were convinced that cigarette smoking was harmful to their health, they still wanted to smoke. Indeed, they claimed a "right to smoke." A third obstacle was that many people in a political position to encourage smoking legislation were smokers themselves, and therefore, had a conflict in interest in passing such legislation. A fourth obstacle was that government was making money from the sale of cigarettes (taxes). The fifth and most significant major obstacle was the tobacco industry, which wanted to continue selling its product unheeded.

Disbelief

The detrimental health effects of smoking were often disregarded, and in many cases, were disbelieved despite the Surgeon General's 1964 report and subsequent medical studies. There are several reasons for this. One is that the tobacco industry was able to transform the issue into one of government regulation versus individual liberty—freedom to choose to smoke (Kagan and Nelson 2001). Another reason is that there is a long delay between the time when smoking is begun and when physical symptoms appear. This delay obscures the connection between smoking and disease (Ravenholt 2006; U.S. Department of Health and Human Services (2000). In addition, smokers did not want to know smoking was bad for them. They enjoyed it and they found ways to rationalize smoking:

a) Smokers do not immediately feel sick from smoking, rather, they enjoy the effects.
b) Cigarettes were provided to soldiers in army rations, and were used by soldiers from the Civil War throughout the Vietnam War to relieve boredom and stress.
c) It seems that nearly everybody smoked: parents and grandparents, doctors and dentists, teachers and college professors.
d) Smoking had invaded popular culture through radio advertising, television shows, and theatre performances.
e) Advertisements showed attractive women and young, healthy men smoking.
f) There was no law against smoking.
g) The tobacco industry adamantly maintained that cigarette smoking was not addictive and did not cause cancer.
h) There was a continuing debate regarding the validity of studies linking cigarettes and cancer, despite the Surgeon General's conclusions and warning.
i) Some enjoyed smoking enough to risk cancer.
j) Some enjoyed the "illicitness" of smoking, which had long been considered immoral.
k) It was difficult to fathom a habit so socially ingrained as being seriously detrimental to their health.

"Right to Smoke"

Smokers did not readily accept restrictions on their "right to smoke." Fischer and Poland (1998) discuss attitudes about the policing of public smoking. They contend that public health authorities indoctrinate the public about the dangers of tobacco smoke to scare the public into shutting out smokers in order to eliminate risk. To smokers, such exclusion is as seen a form of punishment. Using exclusion as social control places responsibility on smokers to conform for the good of the community. Participation is mandated by the community and is, therefore, difficult to oppose. Fischer and Poland further contend that community policing exacerbates class and racial inequities because smoking is more prevalent among the lower class and blacks. One example is that people with money are able to circumvent the "social police" by resorting to private places to smoke. Fisher and Poland also believe that bans criminalize smoking by making it unacceptable in society. They believe the amount of space allocated to smokers is reflective of society's acceptance of smoking. "Giving space is tantamount to granting legitimacy; removing it serves to delegitimize it" (p. 193). They also note that forcing smoking to be done outside (literally) is metaphorically equivalent to making smokers outsiders in society. These authors also describe research suggesting that smokers have to cope with "shifting territories of permission and denial (across time, and between jurisdictions) by being continually on the lookout for 'permissive' spaces in which to smoke" (p. 194). Because of this, smokers feel uncomfortable smoking in public. Finally, they mention that "no smoking" signs stigmatize the habit by making it clear that smoking is disapproved. Smoking is coming to be considered a moral weakness and a social incompetence akin to illegal drug use. In short, Fisher and Poland feel that smokers are stigmatized in the process of purifying society in the desire for public health.

Conflict of Interest

Politicians who smoke may have a conflict of interest in regard to passing smoking legislation (Dixon, Lowery et al. 1991). Dixon and colleagues performed a study to determine whether people who smoke are more likely to oppose public smoking restrictions and tax increases than people who do not smoke. The results of this study were contradictory to other reports that found no relationship between self-interest and

public policy when the policy in question is health insurance, education, affirmative action, etc. The difference, according to these authors is that "public smoking restrictions and tobacco taxes involve unusually clear and salient stakes for respondents" (p. 242). Dixon and colleagues also show that residents of "tobacco states" (North Carolina in this study) are more likely to oppose tobacco control than residents of states that are not "known" for tobacco production (specifically, Illinois). In addition, they find that people who *favor* tobacco control include people who: never smoked, quit smoking, are bothered by smoke, do not profit from tobacco, had parents who did not smoke, have family members who have suffered a serious smoking-related illness, and have few friends who smoke. Their data were collected in 1985 and showed that smokers believed they had a right to smoke in public. In addition, opinion was about evenly split (favoring and opposing) in regard to increases in taxes on cigarettes, federal crop support programs, and cigarette advertising bans.

Another conflict of interest was that the government itself profited from tobacco products in the form of taxes. Tobacco taxes (from imports, exports, and sales) for several decades have been providing a hefty income for the U.S. government, and tobacco companies were willing to "donate" to many government ventures in return for weak tobacco control legislation (Kagan and Nelson 2001). Tobacco was simply a lucrative enough business for many to turn a blind eye to its harmful effects, such that while one arm of the government continued to publish reports denouncing smoking, other arms were hoping tobacco would continue to yield profits for them.

Tobacco Industry Interference

Early state efforts to control tobacco concerned the tobacco industry more than previous federal legislation because the federal regulations, including warnings on cigarette packages and broadcast advertising, were directed toward smokers and did not have much effect on smoking consumption. This is because the smokers were already "hooked." The state efforts, however, would potentially change social norms and attitudes about smoking, which posed a threat to tobacco industry profits. Early smoking bans and restrictions were therefore met with great resistance by the tobacco industry. The tobacco industry had "deep pockets" and used their money to interfere in state and

local anti-tobacco efforts in many ways. Some of them included intimidating anti-smoking advocates with legal, economic, political, or even personal measures; forming alliances with farmers or labor unions; forming "front groups" to covertly act on their behalf; teaming with key politicians; working to weaken legislative measures; and initiating strategic advertising and public relations campaigns.

The following three articles describe some typical experiences regarding legislation. In the final article the authors describe what one locality deemed necessary for success, and what was learned from their experience.

Givel and Glantz (2000) relate the unsuccessful efforts to pass legislation to ban smoking in public places in Dade County, Florida. The efforts of the Miami Group Against Smoking Pollution (GASP) and the Citizen's Committee on Clean Indoor Air (CCCIA) began in the late 1970s. Along with anti-smoking efforts in Minnesota and California, the efforts in Florida were among the earliest in the U.S. Miami GASP began the nonsmoking movement by proposing an ordinance against smoking in public and commercial buildings except in designated areas. The group collected enough signatures on petitions to warrant a special election to vote on their proposal. The tobacco industry quickly organized a campaign against the ordinance. The tobacco industry polled voters to guide their efforts. The first poll (in 1978) revealed 65 percent for the ordinance, 35 percent against, and 5 percent undecided. These results meant that in the absence of interference, the ordinance would have passed. The tobacco industry, however, budgeted $900,000 to a campaign to stop the ordinance. They began with legal attempts to block the special election. When that failed, the industry mobilized Florida's Tobacco Action Network (TAN), which represented the tobacco industry, tobacco growers, sellers, vendors, legislative counsel, and volunteers, to develop a campaign action committee. Their campaign slogan was "Too Much Government." The campaign stressed unnecessary tax costs for the special election, and costs to businesses to conform to the ordinance. To gain attention, they recruited prominent citizens, including political elites (members of congress, state representatives, senators), as well as local attorneys, bank executives, and business leaders. They made use of the local media to liberally televise, broadcast, and print their message. They also distributed bumper stickers, mailings, literature, and they campaigned by telephone and personal contact. Their 1979 poll

revealed 47 percent for the ordinance and 45 percent against. In contrast to the tobacco industry's "deep pockets," GASP, and later, the CCCIA, had relatively small budgets. They used the Fairness Doctrine to get free advertising and borrowed their campaign slogan, "Fairness Toward Nonsmokers" from California. They also claimed that the tobacco industry was "Distorting the Facts." The GASP's efforts failed, and the CCCIA's subsequent efforts failed. The monetary differences in the campaigns were the deciding factor because the tobacco industry was able to gain support of political elites and pay for advertising and professional consulting. The GASP and CCCIA were not. They were further hurt by lack of financial support from local professional societies like the American Cancer Society, the American Heart Association, and the American Lung Association, who claimed to advocate education instead of legislation. In addition, they received no support from politicians and business leaders, they had few volunteers, and lacked experienced campaign and community organizers.

Because GASP's statewide efforts to protect nonsmokers failed in Florida, their next effort, in California, was launched at the local level. Ellis, Hobart et al. (1996) describe experiences in 1985, when Contra Costa County, California proposed an ordinance to ban smoking in enclosed public places, create smoke-free areas in workplaces, and mandate 40 percent nonsmoking seating in restaurants that seat more than 50 people. When it became obvious that the ordinance would likely be accepted, the tobacco industry stepped in to try to prevent its passage. Some efforts were quite benign, and included sending out mailings, making phone calls to residents, posting anti-ordinance flyers, and passing anti-ordinance petitions. Other efforts were more involved and included offering free support for businesses to oppose the ordinance, attending public hearings to oppose the ordinance, and encouraging passage of state law AB996, which would provide weak state tobacco control as well as overturn and preempt local laws and ordinances. The imposition of "outsiders" on a local issue was considered unethical, regardless of the extent of interference. Even with the tobacco industry trying to thwart efforts to pass local smoking ordinances in cities in Contra Costa County, the ordinances passed. Elements that helped included: the coalition of health providers, parents, community organizations; using the media to expose tobacco industry tactics and to provide positive advertising for supporters; performing local surveys which revealed

the desires of the community to enact the ordinance; assuring businesses and restaurants that they would not lose profits; and utilizing neighborhood efforts such as having teenagers purchase cigarettes simply to demonstrate how easy it was.

In another study, Shultz, Moen et al. (1986) describe state smoking legislation in Minnesota between 1975 and 1985. Specifically, they discuss several pieces of legislation, the venues that were covered, and important factors that led to success of these laws. The Minnesota Clean Indoor Air Act that passed in 1975 was a very early comprehensive state level effort in the U.S. movement to ban smoking in public places. This Act banned smoking in restaurants, retail stores, public facilities, workplaces, and hospitals and healthcare facilities, except in designated smoking areas. Even with this legislation, six years later smoking was still considered the most important problem to address in controlling chronic disease factors. In 1983, a Center for Nonsmoking and Health was established with an advisory committee of experts in the varied fields of public health (epidemiology, health education, health behavior research), medicine and nursing, business (labor, wholesale/retail sales, hotel and restaurant management), economics, education, insurance, advertising, state and local government, and community action. The Committee's task was to propose a comprehensive state plan to combat smoking. It identified five target areas to address, all of which were approved by the Commissioner of Health. In addition, the Commissioner added a prohibition on distribution of free cigarettes and a five-cent per pack tax increase to fund the plan—the Omnibus Nonsmoking and Disease Prevention Act, which was enacted in 1985. The target areas identified and covered under this Act included: (1) tobacco use education and prevention were instituted in schools, (2) a multimedia public education and communications campaign were begun, (3) workplace compliance was increased, (4) grants for special projects were established for smoking prevention and cessation, and (5) money was set aside for program evaluation. Support for the Act came from many areas, including the Commissioner of Health, the Governor, Surgeon General Koop, health organizations, professional societies (such as the American Cancer Society), and the business sector in an effort to reduce healthcare costs. As expected, there was opposition from tobacco industry lobbyists, who paid for counter-advertising and supplied prepaid postcards for citizens to mail to their senators asking them to oppose the Act. There was

also opposition from residents who were opposed to the state using part of the cigarette tax funds to support a state sewer project that was necessary to keep neighboring Wisconsin from suing Minnesota. This use of part of the tax funds was double-edged, as it brought additional support for the Act from supporters of the sewer project. The Omnibus Act was passed and several conceptual ideas were developed to assist other states in passing similar legislation. Some of these include focusing on positive aspects of a nonsmoking lifestyle, attacking from multiple angles, assuring business owners that their businesses would not lose money, including experts from many disciplines (advertising, business management, healthcare, education), and linking the smoke-free campaign to a necessary state project to help maintain visibility and to gain support from those who advocate that project.

Brumback (1981) discusses elements needed for a successful campaign based on the experiences of Palm Beach County, FL. This campaign was formed by a Committee on Smoking and Health, which had representatives from the local lung, heart, and cancer societies, as well as the local medical society and the county health department. The committee organized educational programs, especially for the large population of elderly retirees who had a high percentage of respiratory and cardiac illnesses. It also encouraged that group to voice their concerns about public smoking (e.g., to complain). The Committee attempted “small” feats like banning vending machines in hospitals, smoking in public library reading rooms, and in doctor and dentist offices. They compiled fact sheets, support letters from physicians in the area. These small efforts promoted media attention and thus, public awareness of the desire for smoking policy. The Committee organized a public demonstration to City Commissioners by physicians, high school students, emphysema patients, and others. The ensuing public awareness campaign included posters, talks, use of news media, and educational materials. These efforts culminated in a proposed county ordinance to restrict public smoking. When that proposal was defeated, a heightened campaign was launched. Brumback identified several factors that were important in the campaign’s failure, and suggested some factors needed for launching a successful campaign, including developing a positive theme, demonstrating public support (through petition signatures), and generating positive

publicity through the press. Other facts that would help are using opinion polls to direct and monitor campaign efforts and keeping leaders motivated.

Tobacco Trials

The 1972 Surgeon General's report on environmental tobacco smoke (also known as second-hand smoke) left concerns about the health risks of smokers smoldering on the backburner when it purported that smoky environments were unhealthy to nonsmokers. Gradual changes evolved as first airplanes and then cafeterias began having smoking sections as antismoking activists became more and more convinced of their right to clean air and more and more adamant in demanding it. Reports throughout the 1970s and 1980s by the Surgeon General and others continued to affirm the health hazards to nonsmokers, and in the 1980s, the Environmental Protection Agency began testing carbon monoxide yields of cigarettes. The testing led to suspicion that the tobacco industry had not been upfront with the public in regard to the safety of its products. In 1993 the EPA classified second-hand smoke a group A (known human) carcinogen. Representatives of the tobacco industry filed suit against the EPA in turn, because group A classification would enable the Food and Drug Administration (FDA) to control cigarettes as a drug.

Gruber (2001) provides a comprehensive discussion of the "tobacco wars." The EPA's classification of tobacco smoke as a known human carcinogen prompted the first class action lawsuit against the tobacco industry: *Castano, et al. v. The American Tobacco Company*, which was filed in 1994. In this case, 65 law firms pooled their resources and "alleged that the tobacco industry had failed to warn adequately about the addictive properties of cigarettes" (p. 199). Mississippi filed suit later in 1994 on the grounds that "the industry was liable to the state for medical costs even if smokers knowingly contributed to their illness," and that states can sue for medical expenses from manufacturers of harmful products (p. 199). Three other states independently filed suits and the remaining 46 formed a class action suit. The Liggett Group agreed to a settlement and in doing so they provided documentation that condemned the other major tobacco companies. Specifically, Liggett provided documents that revealed that the tobacco industry knew the health dangers of smoking and that they marketed tobacco products to minors. This admission effectively forced other tobacco companies to settle lawsuits as

well. Their strategy was to settle with some provision to protect the industry from future liability.

The first proposal called for tobacco companies to pay states $368 billion over 25 years. In return, the state suits would be settled and the industry would be granted immunity from future individual and class action suits. This proposal was not accepted because it would have provided the tobacco industry a form of "legal insurance" and it would have enabled them to simply pass the costs on to consumers by increasing sales prices.

The McCain Bill was proposed as an alternative. Under it tobacco companies would pay $516 billion to states over 25 years, the FDA would have been given regulatory authority over tobacco products, and youth restrictions would be established. In return, tobacco companies would receive immunity from further state lawsuits, but not from private suits. Tobacco companies considered this proposal unacceptable.

The tobacco industry finally agreed to a proposal known as the Master Settlement Agreement (MSA), in which they would pay states $206 billion over 25 years. In addition, the MSA would institute restrictions on advertising, marketing, and promotional activities, as well as limit lobbying and advocacy activities. [Terms of the MSA are available online at www.philipmorrisusa.com]

All of the settlement proposals had pros and cons for the tobacco industry and the states filing suit. A consideration that Gruber (2001) discussed was inequalities caused to other parties. These issues would all need to be considered in any final settlement. For example, the settlements only involved the major tobacco companies. Smaller, non-participating companies would benefit disproportionately by not having to raise the cost of their brands to cover legal costs. One proposed way to get around that was to have state sales taxes imposed on brands sold by non-participating companies. This, of course, would further benefit states, but would "punish" smokers rather than tobacco companies, because the final cost would be passed on to the consumer.

Another inequity was the enormous legal fees charged by lawyers. They wanted $1.25 billion initially plus an additional $500 million per year afterwards, for 25 years. Even though lawyers getting rich presented an inequity, it was deemed a "cost of doing business" because the alternative to paying the lawyers would have been to institute a

federal tax on all cigarettes to cover the medical expenses, and the fear was that may have never come to pass. A third problem was that by raising the price of cigarettes by 20-25 cents per pack, the estimated amount needed to recover their payments, tobacco companies may actually make a profit. This was certainly not a desirable outcome. Yet another inequality is that lower income people now have higher rates of smoking. This means that hiking up the price of cigarettes may unduly burden the poor. On the other hand, it may prevent more people in that socioeconomic group from starting.

Gruber (2001) looked deeper into the very basic reasons people smoke to discover ways to curb smoking while appropriately "punishing" tobacco companies. He explained the rational model of addiction, in which it is believed that people know cigarettes are addictive but choose to smoke anyway because they perceive that the immediate gratification from smoking outweighs the costs. In addition, smokers do not vary their consumption according to the price of cigarettes. Therefore, increasing the price of cigarettes, either by tobacco manufacturers to recover their legal costs or by state and federal taxes to cover their medical costs, does not significantly affect smoking patterns of addicts. The implication is that simply "fining" tobacco companies is not an effective way to either punish them or to deter smoking. Note, however, that according to the Surgeon General's Report on Preventing Tobacco Use Among Young People (U.S. Department of Health and Human Services, 1994), increasing the costs of cigarettes is considered effective in reducing adolescent smoking, and this provides a strong rational for increasing the cost of cigarettes.

Because 8 of 10 smokers (in 1992) desired to quit and expected to quit sometime in the future, Gruber (2001) believes it is important to find other factors that might promote smoking cessation. These other factors, which he calls externalities, include poor health, potential for having low birth-weight babies, needing more sick days, loss of productivity, and annoying nonsmokers. Antismoking advertisements were shown to reduce consumption in 1967-1971, when the Fairness Doctrine was in effect, requiring equal air time for antismoking advertisements. Therefore, one way to promote smoking cessation while at the same time punishing tobacco companies would require tobacco companies to pay for antismoking advertisements.

In summary, Gruber believes it was important for the final settlement agreement to consider potential inequities among all those involved, and that settlement money should be used for smoking cessation and efforts to reduce youth smoking. With these factors in mind, tobacco companies would be satisfactorily punished without undue burden on any single faction, and smoking cessation and prevention would be promoted.

Chapter Summary

This chapter has presented a history of smoking in the U.S. including the introduction of tobacco, spread of tobacco use, and subsequent findings that tobacco smoking harms human health. The chapter continued by presenting information about obstacles to tobacco regulation, including that smokers often disbelieve the habit is harmful and that the tobacco industry used tactics to prevent legislation from being passed. The chapter concluded with a discussion of the "tobacco wars," which led to the downfall of the tobacco industry. The next chapter discusses where the U.S. stands today in regard to smoking and health.

CHAPTER 3: SMOKING AND HEALTH

As discussed in Chapter 2, cigarettes have maintained a stronghold on the American public through an interesting and complex history—one that involves money (tobacco industry profits) (Kagan and Nelson 2001), politics (government regulation versus individual rights) (Fischer and Poland 1998), lies and deceit (by the tobacco industry regarding addictiveness and harmfulness of smoking) (Gruber 2001), and strategic advertising and public relations campaigns (Slade 2001). That stronghold loosened in the early 1990s, when the Environmental Protection Agency accused the tobacco industry of hiding the dangers of smoking from the public. Subsequent lawsuits against the tobacco industry filed by all 50 states seeking to recover medical expenses (e.g., Medicaid) for sick smokers resulted in the tobacco industries agreeing to pay $206 billion to the states under the Master Settlement Agreement (Gruber 2001). These "tobacco wars" finally and solidly established financial liability of the tobacco industry for smoking-related illnesses and confirmed the health hazards of smoking.

In the wake of the "tobacco wars" lies the realization that over 430,000 people in the U.S. and 3,000,000 people worldwide die from tobacco-related illnesses each year. The death toll from smoking-related illnesses surpasses the number of all deaths from alcohol, illegal drugs, murders, suicides, car accidents, and AIDS combined (Campaign for Tobacco-Free Kids 2007). Mokdad, Marks et al. (2004) presented an article describing the "actual" causes of death in the U.S. These "actual" causes reflect the overall physical problems that led to death, rather than the specific diagnosis. In this way, some heart attacks are classified as being caused by smoking, while others are classified as being genetic, for example. This measure of death enabled the authors to identify the top ten root problems that led to deaths in the year 2000. Their results indicate that tobacco use was the number one cause of death in the U.S. in 2000.

Deaths and illnesses caused by smoking include heart disease, lung disease, stroke, and cancer (Figure 3.1). Shaw, Dorling et al. (2002) estimate that smoking is responsible for 25 percent of heart disease deaths, 82 percent of lung cancer deaths, and 83 percent of deaths from bronchitis and emphysema. What is profound is that with the

exception of second-hand smoke-related illnesses, when caused by smoking, these deaths are self-inflicted and completely preventable.

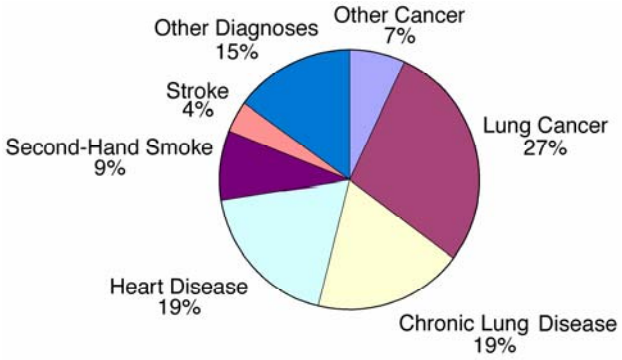

Figure 3.1: Smoking deaths, by illness (Centers for Disease Control 2002).

According to the Centers for Disease Control and the United Health Foundation, approximately 45 million people (21 percent of all adults) in America currently (2006) smoke. The prevalence of smoking is generally higher in the eastern half of the U.S., and is especially high across the Southeast and Midwest (Figure 3.2).

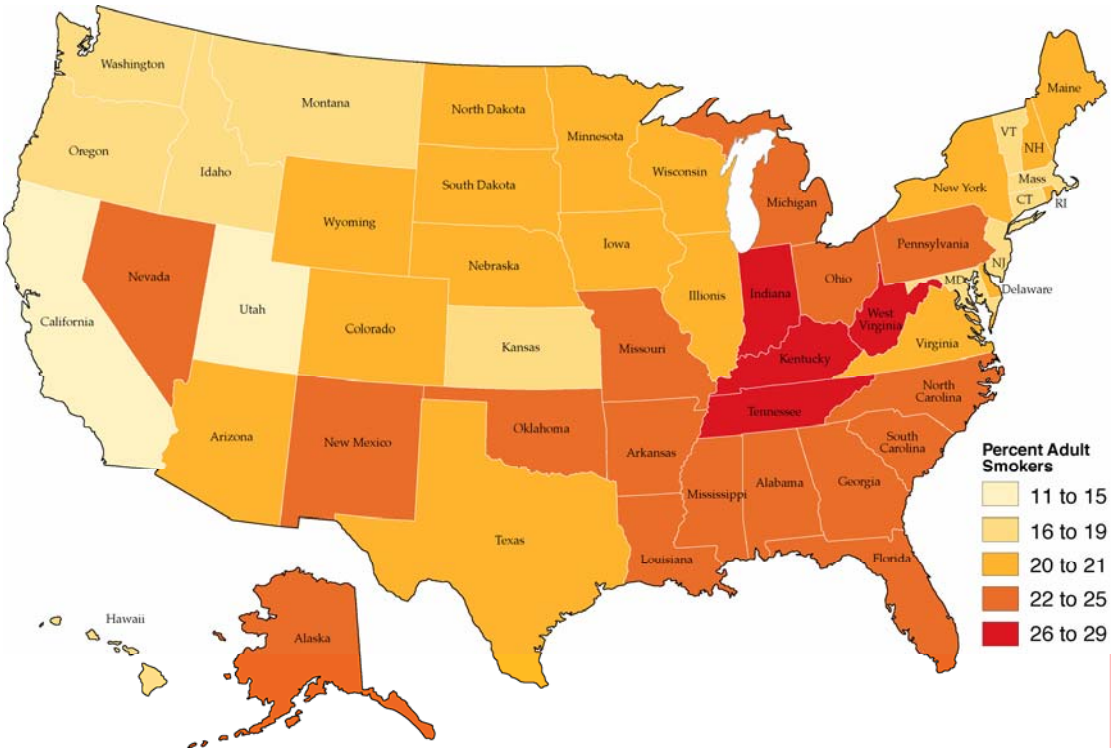

Figure 3.2: Smoking prevalence in the United States (United Health Foundation 2007).

At 29 percent, Kentucky has the highest percentage of smokers in the nation. One reason for its high percentage may be that Kentucky is part of the "tobacco belt," where state economies are highly dependent on tobacco. Ninety-eight percent of Kentucky's 120 counties grow tobacco, producing 70 percent of all burley for cigarettes. The other 30 percent of burley tobacco is grown in Tennessee, Indiana, North Carolina, Missouri, Ohio, Virginia, and West Virginia (Wikipedia 2007). In addition to Kentucky, three of these states have especially high percentages of smokers: Indiana, Tennessee, and West Virginia (27 percent each) (Centers for Disease Control 2007; United Health Foundation 2007).

According to the surgeon general, reducing cigarette consumption in the U.S. is essential to improving the health of Americans and should be reduced to under 12 percent by 2010 (Centers for Disease Control 2006). To achieve this enthusiastic goal will require work of many advocates. As noted in the previous chapter, an abundance of research has been performed regarding smoking and health. Government studies have thoroughly documented that smoking is more common among blacks than whites, poor than wealthy, less educated than well educated, and men than women (U.S. Department of Health and Human Services 2000). Specific studies have been performed on the smoking habits and/or effects on various subgroups, especially including adolescents and pregnant women.

Another direction in which research has focused is in regard to smoking cessation and intervention methods. Cessation aids include nicotine replacement products, medication, hypnosis, and acupuncture. Interventions to reduce smoking include advertising restrictions, education efforts, tax increases, and smoking bans (Myers 2006). According to (Emmons 2000, p. 11):

> "We are at a historic crossroads in tobacco control. Never before has there been as much attention focused on this very important public health issue. In this climate, there is unprecedented opportunity to reduce the prevalence of smoking in this country to historic lows."

The task now is to research and implement intervention strategies. Research on intervention strategies for teenagers need to be directed toward (1) identification of safe and effective cessation programs that are specifically geared toward adolescents; (2) development of information dissemination channels (internet, healthcare providers,

colleges, families); and (3) determination as to whether restrictive smoking policies are effective in schools, colleges, and other places teenagers frequent. Key research issues Emmons identifies regarding adult intervention are: (1) increasing use of cessation programs; (2) studying diffusion of successful cessation programs; and (3) determining how to reach low-income smokers in particular.

Another study by Hopkins, Briss et al. (2001) provides a lengthy and detailed review of interventions employed prior to publication. Conclusions from this review comprise the recommendations of the Task Force on Community Preventive Services (TFCPS) and are available in the *American Journal of Preventive Medicine* 2001, Volume 20, Supplement 2.

Some other excellent resources for information on smoking and health are available online. One resource is the Centers for Disease Control and Prevention's site for Smoking and Tobacco Use (http://www.cdc.gov/tobacco/). This website has basic "fast facts" that provide information and statistics on tobacco-related illnesses and deaths, costs and expenditures, and tobacco use. There are links to all the surgeon generals' reports and issues of Mortality and Morbidity Weekly Report (MMWR), as well as various surveys and fact sheets. In addition, the site provides information on how to quit smoking and resources to assist in developing community tobacco control campaigns.

The Campaign for Tobacco-free Kids is devoted to providing information regarding tobacco and youth. Their site (http://www.tobaccofreekids.org/) contains "special reports." One example is entitled "FDA Authority Over Tobacco—Congress Should Pass Legislation to Protect America's Kids and Health." The site shows a box of Kraft Macaroni and Cheese with "FDA Regulated" stamped on it, alongside a box of Marlboros stamped "NOT FDA Regulated," highlighting this discrepancy in a way that kids can understand. Fact sheets with titles like "Tobacco Harm to Kids," "The Path to Smoking Addiction Starts at Very Young Ages," and "Tobacco Use Among Youth," are also accessible.

Tobacco.org (www.tobacco.org/) provides up-to-date information about places worldwide where news about smoking is making headlines. It is possible to search articles published in specific newspapers, the *New York Times* or the *Wall Street Journal*, for example. News articles can also be accessed by topic, state or country, lawsuit, or

organization. I selected vaccines from the list of topics available and was presented with an article entitled “Doctors hope to switch off brain's craving for tobacco,” which was published in the *Times of London* in January 2007. The idea of a vaccine originated from studies that showed injuries to a part of the brain called the insula resulted in immediate loss of the urge to smoke. The link for vaccines also presents information about medications that help suppress the urge for nicotine. Varenicline (Chantix by Pfizer) and bupropion (Zyban and Wellbutrin by GlaxoSmithKline) are two medications that are currently available. Tobacco.org also includes an archive of tobacco advertisements as well as an extensive history of smoking.

Americans for Nonsmokers’ Rights (ANR) has a website (www.no-smoke.org/) that links to facts about second-hand smoke, economic impacts of smoking, preemption, tobacco industry tactics to prevent tobacco control, and other related topics. The site links to “research alerts” as well. One alert reads: “A study published in the *Medical Journal of Australia* has found that children exposed to cigarette smoke in cars have double the risk of asthma.” In addition, the site provides strategies for “going smokefree” at home, at work, and in the community. Some messages presented in March 2007 include “Smokefree Casinos in Colorado,” “Thanks to you, New Mexicans will soon breathe easier,” “Texas Wins National Award for Local Smokefree Laws,” and “Kentucky Wins National Award for Local Smokefree Laws.” No-smoke.org is especially notable for its lists of municipalities and states with smoking ordinances, maps of smokefree cities and states, and numerous lists of smokefree places including airports, hotels, colleges, and prisons.

A final site of interest is hosted by the American Lung Association. State Legislated Actions on Tobacco Issues (SLATI) (http://slati.lungusa.org/) offers a free downloadable publication entitled “The American Lung Association State Legislated Actions on Tobacco Issues 2005 Report,” which contains a wealth of information about laws in every state. A noteworthy feature is its interactive database, which can be searched for specific information regarding place, type of regulation, youth access measures, and more. Another feature of this site is a link for tobacco trend alerts. The trend alerts in March 2007 are for waterpipe tobacco use and marketing of candy- and alcohol-flavored cigarettes. Waterpipes are also called “hookahs” and are small tobacco

pipes used socially among 18-24 year-olds. Waterpipes are not new devices. This method of smoking originated in Persia and India, and waterpipes have been used for smoking opium and hashish in the Middle East and Europe. Menthol flavoring has been added to cigarettes since the 1950s, and other flavorings including wintergreen, lime, and lemon were experimented with in the 1960s and 1970s. R.J. Reynolds introduced a new line of cigarettes, Camel Exotic Blends, in 1999. The first flavors in this line were citrus and vanilla. Cinnzabar (cinnamon and spice) was added in 2000, and Bayou Blast (berry-flavored) was available during Mardi Gras in 2003 and 2004. Brown & Williamson also has a line of flavored cigarettes, Their Kool Mixx includes Caribbean Chill, Mintrigue, Midnight Berry, and Mocha Taboo.

This chapter has presented some issues regarding smoking and health, including information about smoking-related morbidity and mortality, smoking prevalence, and research that has been performed. In the next chapter, I present issues surrounding smoking control.

CHAPTER 4: SMOKING CONTROL LAWS

Several legal strategies have been employed to reduce tobacco consumption: tax increases, advertising regulations, restricting smoking in or to certain areas, and restricting minors' access to tobacco products. This chapter begins by describing federal and state laws to control smoking. Then I posit that smoking control measures, which are generally implemented by the government, and which may be more plausibly implemented by the public by way of state ballot initiatives.

Tax Increases

Cigarette tax increases have been imposed by both federal and state governments. They work by making cigarettes cost more than their perceived worth. According to a commentary by Matthew L. Myers (2006, p. 1), President of the Campaign for Tobacco-Free Kids:

> "There is no faster, more efficient or more effective way to reduce tobacco use than to substantially raise the price of tobacco products through increased tobacco tax. A ten percent increase in the price of tobacco products results in a three to five percent decline in adult tobacco consumption and has a greater impact on children."

The problem with using this method of intervention is that state and federal governments have been reluctant to raise taxes. One reason is when people stop buying tobacco products, the government *forfeits* money no longer collected from them in the form of tobacco taxes. Another reason is that tobacco farmers are hurt by tobacco tax increases, and areas that are tobacco-dependent are already feeling the effects of lower profits. Some government entities are reluctant to pass legislation that will undoubtedly cause tobacco farmers further revenue loss. Yet another problem with using tax increases to lower tobacco use is that the "tobacco industry has often countered the impact of tobacco tax increases through major discounting of the most popular cigarette brands" (p. 8). Another criticism of tax increases is that while they are especially effective among youth, who are generally unable to afford the unnecessary habit, they may also be considered discriminatory because they have a greater impact on poor people**.**

Federal Regulations

In addition to tax increases, the federal government has often enforced regulations regarding advertising. In 1965 Congress passed the Federal Cigarette Labeling and Advertising Act. This regulation was responsible for the warning "Caution: Cigarette Smoking May be Hazardous to Your Health" being printed on cigarette packages. The wording was changed in 1970 to "Warning: The Surgeon General Has Determined that Cigarette Smoking is Dangerous to Your Health." In 1984, the Comprehensive Smoking Education Act required this statement to be rotated with other warning messages. Warnings are still printed on cigarette packages today. Another advertising regulation, the Fairness Doctrine, was passed by the Federal Communications Commission in 1967. It mandated that radio and television stations donate equal air time to smoking prevention messages as was used for smoking advertisements. The resulting broadcasts spread the word that cigarette smoking is harmful. In 1970, the Public Health Cigarette Smoking Act ended broadcast advertising (and unfortunately, also the free advertising provided to smoking prevention).

Airline regulations are another type that the federal government imposed. In 1988 Congress banned smoking on domestic flights of less than two hours. In 1990 the ban was extended to flights of less than six hours, and in 1996 Congress extended the ban again, this time to include all flights originating in the U.S. The federal government has also passed regulations restricting smoking in federal buildings (1979), as well as in both U.S. Postal Service facilities and the White House (1993).

State Laws

In addition to (or in lieu of) federal tobacco control regulations, today (2007), every state has a smoking policy (Gruber 2001). Arizona led the way with a 1973 ban on smoking in public places. Other states followed suit. In 1974 Connecticut became the first state to restrict smoking in restaurants. Minnesota followed in 1975 by restricting smoking in most buildings open to the public. New Jersey restricted smoking in restaurants and public places in 1978. As is obvious from these early measures, state laws vary both in date of implementation and in restrictive measures.

While it would seem that any statewide regulation would be a step in the right direction to reduce smoking, this is not necessarily the case. Preemptive legislation prevents local jurisdictions from enacting regulations that are stricter than the state law. Preemptive laws are intended to appease tobacco control advocates without antagonizing the "deep-pocketed" tobacco industry. Preemption thus results in weak state laws that prevent local governments from implementing stricter regulations. For example, a preemptive law might prohibit smoking in the workplace, but exempt sports arenas, convenience stores, and private businesses, thus negating much of the value of the regulation, while making it impossible for smaller political units to establish stricter effective smoking restrictions in the exempted places.

As of February 2007, 13 states had preemptive state legislation on "clean indoor air" (Figure 4.1): Oregon, Montana, Utah, South Dakota, Iowa, Oklahoma, Michigan, Tennessee, Florida, North Carolina, Virginia, Connecticut, and New Hampshire. Preemption varies among these states, but generally includes local ordinances regarding public places, workplaces, restaurants and bars, or some combination thereof. Exceptions may include ordinances enacted before or after a particular date or regarding a specific place, such as school districts.

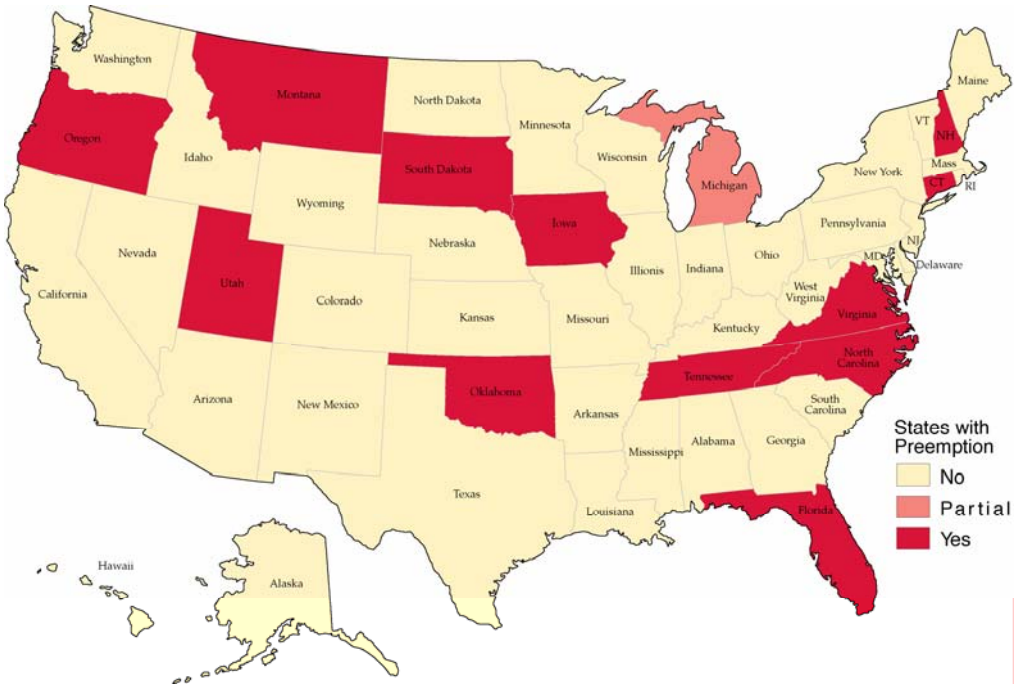

Figure 4.1: Preemptive state clean indoor air legislation as of February 2007 (American Lung Association 2007).

At the other extreme, 21 states have “100 percent smoke-free laws.” These laws prohibit any smoking in *all* workplaces (retail stores, factories, groceries, etc), restaurants, and/or bars (Figure 4.2). Notice, however, that only 8 of these states prohibit smoking in *all three* venues. These states are Washington, Hawaii, Ohio, New York, Delaware, New Jersey, Maine, and Rhode Island. The remaining 13 states prohibit smoking in one or two of these three venues. These states include California, Nevada, Idaho, Montana, North and South Dakota, Utah, Colorado, Louisiana, Florida, Connecticut, Massachusetts, and Vermont (Americans for Nonsmokers' Rights 2007).

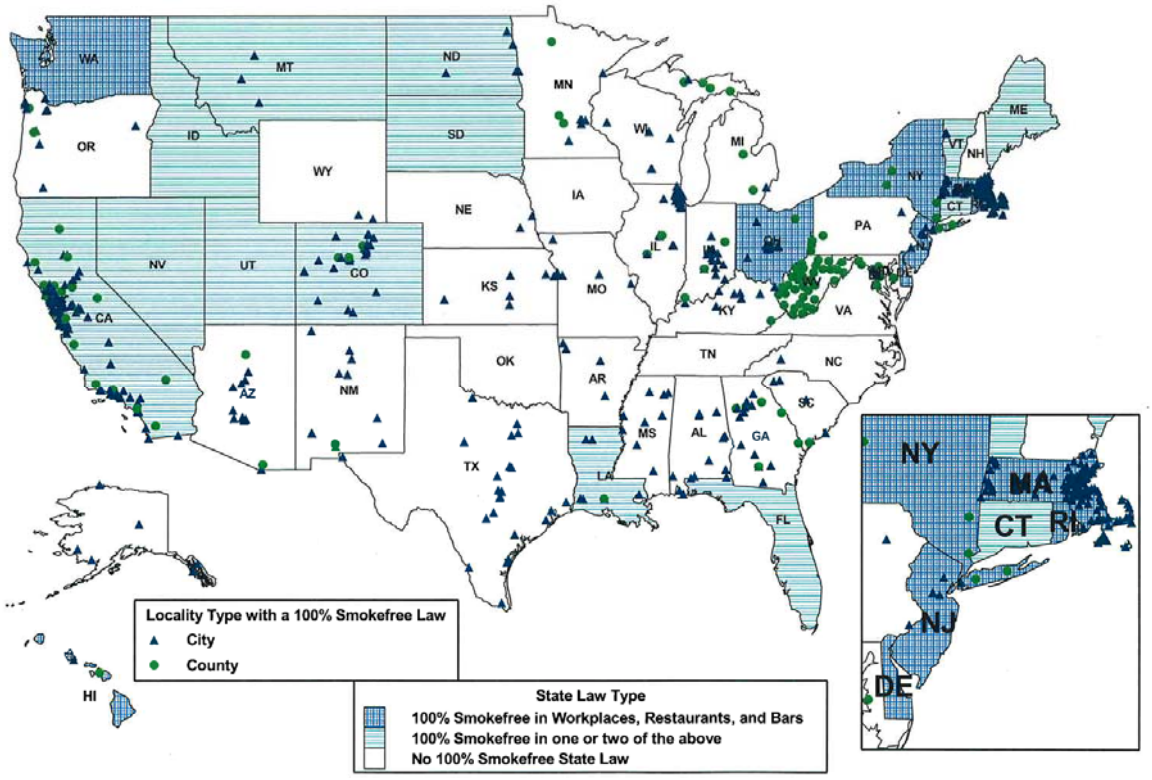

Figure 4.2: 100 percent smoke-free laws in the U.S. (Americans for Nonsmokers' Rights 2007).

Comparing Figure 4.2 (above) with Figure 3.2, which shows the prevalence of smoking, it is evident that the four states with the highest prevalence of smoking-related deaths (Kentucky, Indiana, Tennessee, and West Virginia) do not have 100 percent smoke-free laws. In these “tobacco belt” states, the absence of 100 percent smoke-free

laws is likely a result of efforts to protect tobacco farmers whose livelihood depends on the sale (and subsequent use) of tobacco products.

Local Laws

Local laws are also important. According to the Center for the Advancement of Health (2005): "Most smoking policy successes begin with local communities whose example often leads to statewide smoke-free regulations." California is a prime example, since its laws "were enacted only after a string of localities came together to change how Californians think about smoking—and where it is acceptable."

Local laws have some advantages over state laws. First, local policy makes the public aware that others in their immediate surroundings disapprove of smoking. As described above, this is important in changing public attitudes. Another advantage over state laws is that at the local level the public is generally more inclined to become involved. This is critical to a successful campaign (Nathanson 1996). Finally, the sheer number of cities and counties makes it more difficult for tobacco lobbyists to intercede at the local level than at the state level.

According to the American Nonsmokers' Rights Foundation, as of January 2007, there are 216 municipalities in the U.S. that have local restrictions on smoking in workplaces, restaurants, and bars (Figure 4.3). In addition, over 2,200 have bans that restrict smoking in either one or two of these venues. These numbers continue to grow, showing that the desire for smoking bans is increasing.

The American Nonsmokers' Rights Foundation is the national repository of local tobacco-related ordinances and regulations in the U.S. This nonprofit organization seeks to increase awareness of smoking-related issues such as health effects of secondhand smoke, social norms, youth tobacco addiction, and the right to smokefree air. The Foundation provides educational resources, training seminars, and information about secondhand smoke and tobacco industry tactics to hinder smoke-free regulations. Their website is www.no-smoke.org.

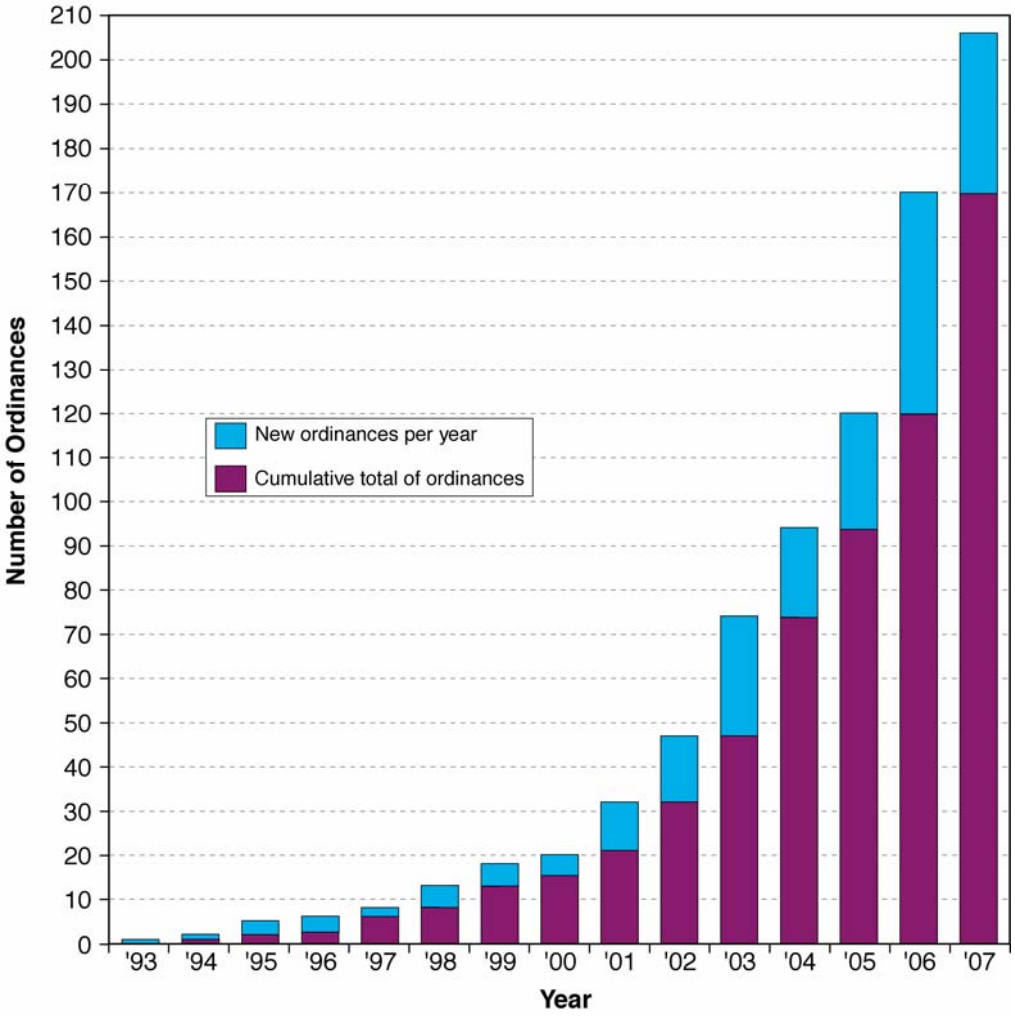

Figure 4.3: Cumulative graph of municipalities with local 100 percent smokefree laws in all workplaces, restaurants, and bars, as of January 2007 (American Nonsmokers' Rights Foundation).

Local bans exist in many cities. Among the earliest were Berkeley (1977), San Francisco (1983), and Los Angeles (1985), California. Other cities with smoking bans including Helena, MT; Lincoln, NE; Houston, TX, New York, and Washington, DC. Local bans also exist in small towns and rural communities like Georgetown, KY; Snowmass Village, CO; Shorewood Hills, WI; Mayersville, MS; and Wirt County, WV. (See Figure 4.3; for a complete list, see American Nonsmokers' Rights Foundation, Local 100 percent Smokefree Laws in all Workplaces, Restaurants, and Bars: Effective by Year, available at www.no-smoke.org.)

Laws—Who Decides?

The great majority of smoking regulations at all levels (city, county, state) were implemented by legislators (e.g., governor, city council), rather than by popular (ballot) vote. This method of implementation is preferable because only a small number of legislators need to be convinced of the benefits of legislation for it to be passed. However, it can just as easily be considered a poor way of making a decision, because the legislators themselves may smoke or have other interests that prevent them from voting in favor of a ban.

Results from a March 2007 internet search (Google) using keywords "percent Americans favor smoking bans" include several "hits" that support the notion that more people may currently favor smoking bans than oppose them:

a) February 27, 2007: Wisconsin / Survey finds many support smoking ban. The random telephone survey of 500 residents conducted Feb. 17-19 found 64 percent favor a proposal offered by Gov. Jim Doyle to ban smoking statewide
b) February 1, 2007: Ellis to present statewide smoking ban measure today: Sixty-six percent of Texans favor making the state's workplaces, restaurants and bars smoke-free, according to a survey conducted by pollster Mike Baselice earlier this month on behalf of "Smoke-Free Texas," which is advocating the legislation. (http://www.offthekuff.com/mt/archives/008751.html)
c) January 17, 2007: 71 percent in Virginia want smoking ban: Fans of indoor-smoking ban fired up: Supporters of legislation to prohibit smoking in most public, indoor places hope to sway state lawmakers with a poll showing 71 percent of Virginia voters favor such a ban. The poll of 625 registered Virginia voters also showed support across party lines, with 78 percent of Democrats favoring it, 69 percent of independents and 66 percent of Republicans. (http://www.potomacnews.com/servlet/Satellite?pagename=WPN/MGArticle/WPN_BasicArticle&c=MGArticle&cid=1149192697051&path)
d) November 11, 2006: Clean Air Choice - News Article Duluth News Tribune: St. Louis County voters favor smoking ban: According to the poll, 64 percent of St.

Louis County registered voters likely to vote Tuesday favor a county ordinance prohibiting smoking in most indoor public places

e) September 26, 2006: Illinois Voters Favor Statewide Smoking Ban: Most Illinois voters favor a smoking ban in all indoor public places, including bars and restaurants, according to a Copley News Service poll. Fifty-four percent of respondents supported a comprehensive statewide smoking ban, 39 percent were opposed, and 7 percent were undecided. (www.no-smoking.org/sept06/09-26-06-2.html)

At this point in time then, it might be argued that a decision to implement a smoking ban may be more reasonable to pass bans by the public vote rather than by legislator vote. Ballot votes in 2005 and 2006 support this statement. As noted above, in 2005 residents of Washington were asked to vote on whether or not to strengthen their existing statewide ban. The results from every county were in favor of the stronger ban. In 2006, residents of Arizona, Nevada, and Ohio were also asked to vote on whether to implement strict, lenient, or no statewide smoking ban. All three states passed the stricter bans. The specific provisions of these initiatives were described in Chapter 1, and details of the vote results are discussed in the analysis chapter.

Chapter Summary

This chapter has presented information about tobacco control efforts at the federal, state, and local levels. These efforts include tax increases, advertising regulations, restrictions on where smoking is allowed, educational programs, and youth access restrictions. Information about current state laws, why they are important, and their preemptive status over city and county legislation is also presented, as is an overview of local laws. Maps are provided that show both ends of the smokefree spectrum: states with 100 percent smokefree air laws and states with preemptive smokefree air laws. The suggestion is proposed that public votes may be preferable to legislative votes in regard to implementation of statewide smoking bans. A detailed analysis of the results follows. The question I raise in this thesis (and in the next chapter) is whether other states are ready to follow suit.

CHAPTER 5: CARTOGRAPHIC PROJECT AND ANALYSIS

The major objective of this research, as stated in Chapter 1, is to develop a method of predicting the results of statewide smoking ban initiatives using geographic and cartographic analysis. The idea stems from the November 2006 election results, in which residents of Arizona, Nevada, and Ohio voted to pass statewide smoking bans. An examination of the data led me to suspect a positive relationship between favorable votes and the location of cities. Such a relationship was mentioned by Moon and Barnett (2003), who noted that higher levels of smoking are a rural phenomenon in New Zealand, and also by Ross and Taylor (1998) in regard to differences between cities in North Carolina.

The first question to be addressed is whether indeed there is a positive relationship between city size and the percentage of residents who vote yes to a statewide smoking ban. My hypothesis is "yes," a positive relationship will exist. A second question is whether existing local (city or county) smoking-free regulations guarantees a favorable percentage of votes. This question stems from the 2005 vote in Washington in which all counties voted in favor of strengthening existing smoking policy. This idea is also supported by Hahn, Rayens et al. (2006) who showed an increase in support for bans after they had been implemented. My hypothesis is also "yes," viz., the presence of local regulations assures a sufficient percentage of votes to pass the initiative. In this chapter, I describe and assess the vote data from Arizona, Nevada, and Ohio, and explain how I use geographic and cartographic analysis to assess the hypotheses above. In the following chapter I explain how I use these results to project the outcome of smoking ban votes for Kentucky.

Hypothesis 1: There is a positive relationship between city size and percentage of county residents who vote in favor of a statewide smoking ban

To assess this hypothesis, I began by visiting each state's website and acquiring data on the total number of "yes" versus "no" votes for each county. My preliminary review of the county vote results led me to suspect a positive association between counties with a favorable percentage of "yes" votes and counties that contained large

cities. To test this, I constructed choropleth maps showing the total percentage of votes for each county as either 50 percent or more (green) or less than 50 percent (red) (Figures 5.1-5.3). I then obtained the city populations for each of the three study states from the U.S. Census Bureau (2000) (www.census.gov). On the choropleth maps, I located cities with a population >1,000,000. All of these were in counties that voted yes. Then I added cities with a population of at least 500,000. They were all in counties that voted yes as well, so I added cities with at least 100,000 residents and obtained the same results. When I added cities with at least 50,000 residents, I found that one, Lake Havasu City, Arizona, was in a county (Mohave County) with less than 50 percent of yes votes. Noting this percentage, but continuing, I added cities with at least 25,000 residents. I found that two other cities, Bullhead City and Kingman, were also in Mohave County. At this point, my method had become both cumbersome and time-consuming. Despite the three cities in Mohave County, I was convinced that a positive relationship does exist between city population size and percent of county votes favoring a smoking ban.

Following this procedure I have shown that of the three states' 120 counties (15 in Arizona, 17 in Nevada, 88 in Ohio), only one (Mohave County) contained any city with over 25,000 residents that voted against a smoking ban. Stated another way, of the 89 cities (24 in Arizona, 6 in Nevada, and 59 in Ohio) with over 25,000 residents, only three were in a county that voted against the ban, and all three were in the same county (Figures 5.1-5.3). I next looked at the results of each state map individually, beginning with Arizona.

The percentage of yes votes in Arizona counties (n=15) ranged from 41 percent to 62 percent. The lowest was LaPaz County and the highest was Coconino County. Five counties, or one-third, voted no: Mohave, Lapaz, Gila, Graham, and Greenlee. As stated, Mohave County contains three large cities: Lake Havasu City (population 55,000), Bullhead City (39,000), and Kingman (25,500). Therefore, Mohave County was anticipated to vote in favor of the smoking ban. Three other counties had no votes (Gila, Graham, and Greenlee), and they are clustered together in the eastern part of the state. There is no obvious *visual* explanation for this.

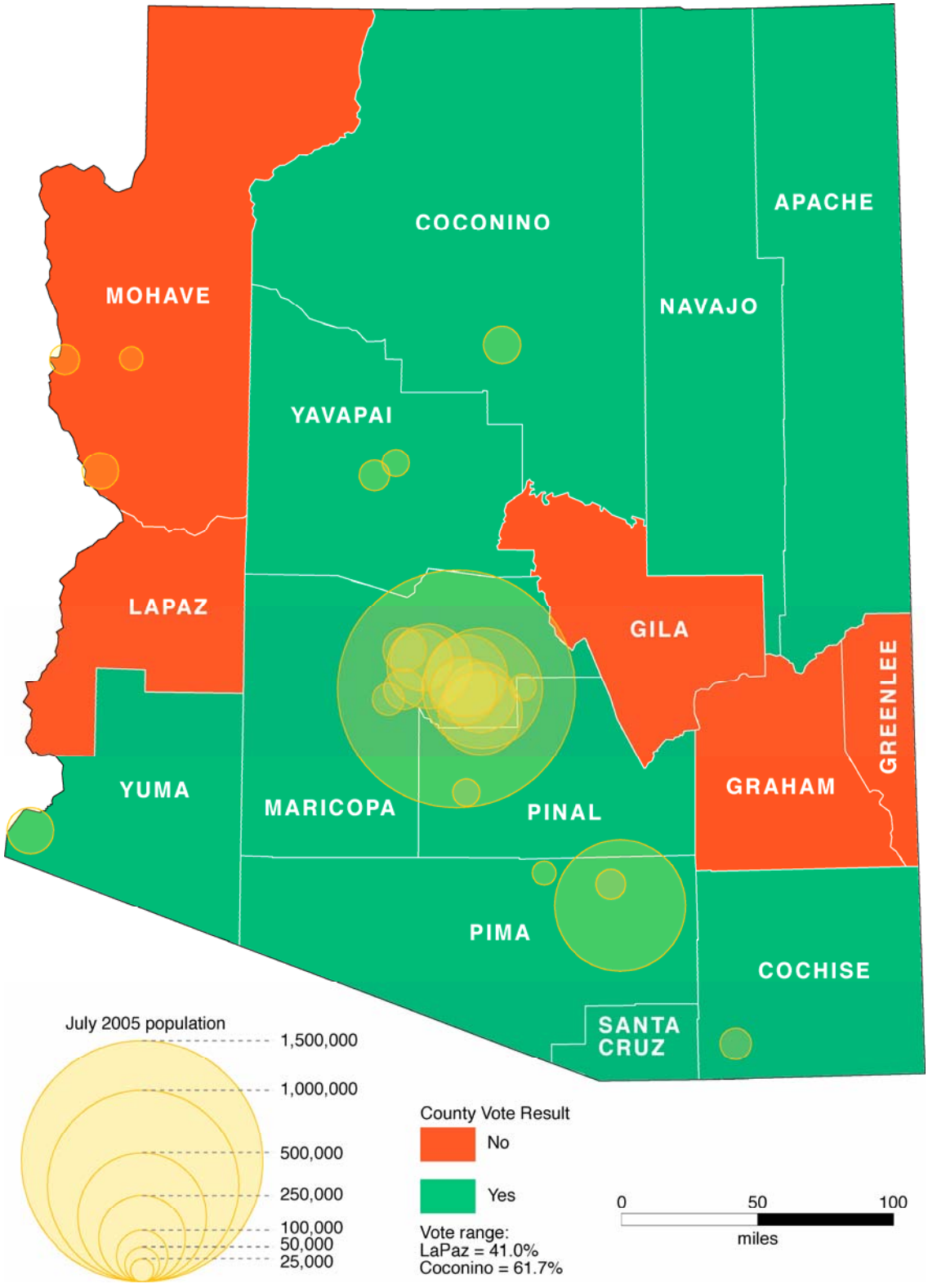

Figure 5.1: Arizona county votes and location of cities.

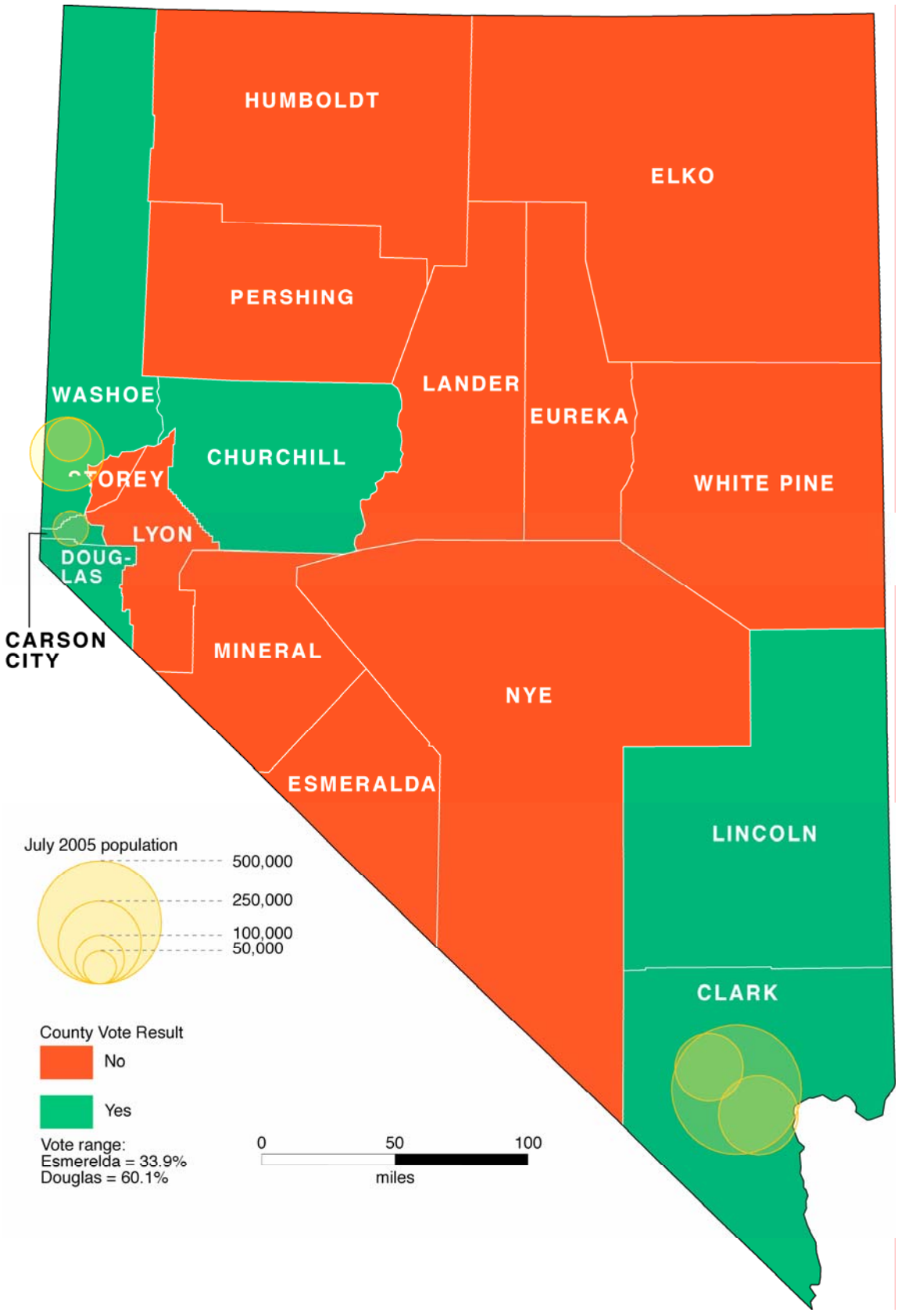

Figure 5.2: Nevada county votes and location of cities.

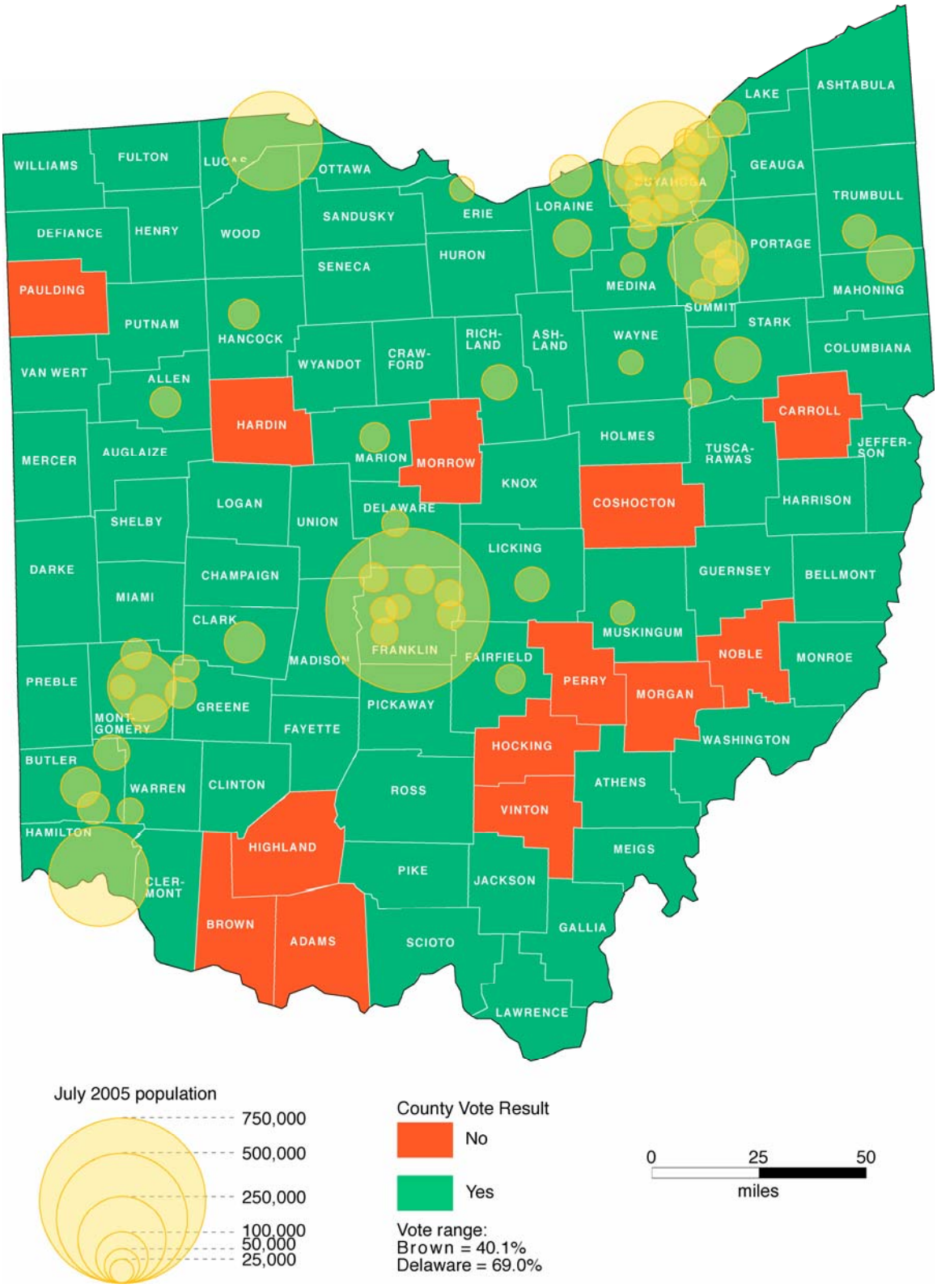

Figure 5.3: Ohio county votes and location of cities.

The range of votes in Nevada counties (n=17) was from 34 percent to 60 percent. The lowest was Esmerelda County and the highest was Douglas County. Of interest, 11 county vote percentages were under 50 percent and only 6 county percentages were over 50 percent. The map of Nevada county votes shows this as a large swath of counties with unfavorable votes vertically down the middle of the state. Two of the counties (Clark and Lincoln) with yes votes are located in the extreme southeastern part of the state. Clark County is home to the city of Las Vegas. Lincoln County is its northern neighbor. The other four counties with yes votes were Washoe, Churchill, Carson City, and Douglas. Three of these are located along the northwest edge of the state. Washoe County is home to the cities of Reno (population 203,000) and Sparks (82,000). Carson City County is home to Carson City, which has a population of 56,000. Of interest is that adjacent Storey and Lyon counties voted against the ban.

The range of votes for Ohio counties (n=88) was from 40 percent to 69 percent, with Brown County the lowest and Delaware County the highest. Overall, 13 of Ohio's 88 counties voted against the ban. There is some clustering among these 13 counties. Brown, Adams, and Highland are contiguous counties in the southern part of the state near Cincinnati. Vinton, Hocking, Perry, Morgan, and Noble form a string of Appalachian Ohio counties to the southeast of Columbus. The remaining five counties are spread horizontally across the north central part of the state.

One factor that might explain a relationship between city population and yes votes is the difference in demographics between cities and rural areas. Recall that relationships have been established between smoking *prevalence* and various demographic factors, including education and income. Drawing on this observation, one thought is that people who live in cities are more educated and have higher incomes compared with people who live in rural areas, and therefore, are less likely to smoke and less likely to tolerate smoking. Another possibility is that people who live in cities have more access to smoking cessation aids and more exposure to smoking interventions.

Next I needed to translate this visual relationship between city population size and percentage yes votes into a form that would allow me to predict voting results in other states. The first step was to obtain the data for both variables at the same scale. The vote data I have is at the county level, so I began searching for county-level data that would

provide a measure of "urbanness." Included in the U.S. Census Bureau's population data is a measure called "percent urban," defined as the percentage of people who live in an urban versus rural area within their county. If these new data *further* demonstrate the relationship I have already established, I will be able to make a statistical correlation for other state vote outcomes.

Revised Hypothesis 1: There is a positive relationship between the percentage of a county's residents who vote in favor of a state smoking ban and the percentage of a county's residents that lives in an urban area.

To test this revised hypothesis, I first constructed scatter plots of the data for each of the three study states, showing county percentage urban on the x-axis and percentage yes votes on the y-axis. As previously mentioned, scatter plots were used by Wilkinson (1993) to show a relationship between life expectancy and income, and by Kaplan (1996) to show a relationship between death rate and income.

Arizona and Nevada have few counties (15 and 17, respectively), and therefore have scant data for statistical analysis. A scatter plot of Arizona's data appears to show a positive relationship between county percent urban and percent yes votes, however, the relationship does not show up statistically (adjusted r square -.001; p=.339; 95 percent confidence) (Figure 5.4).

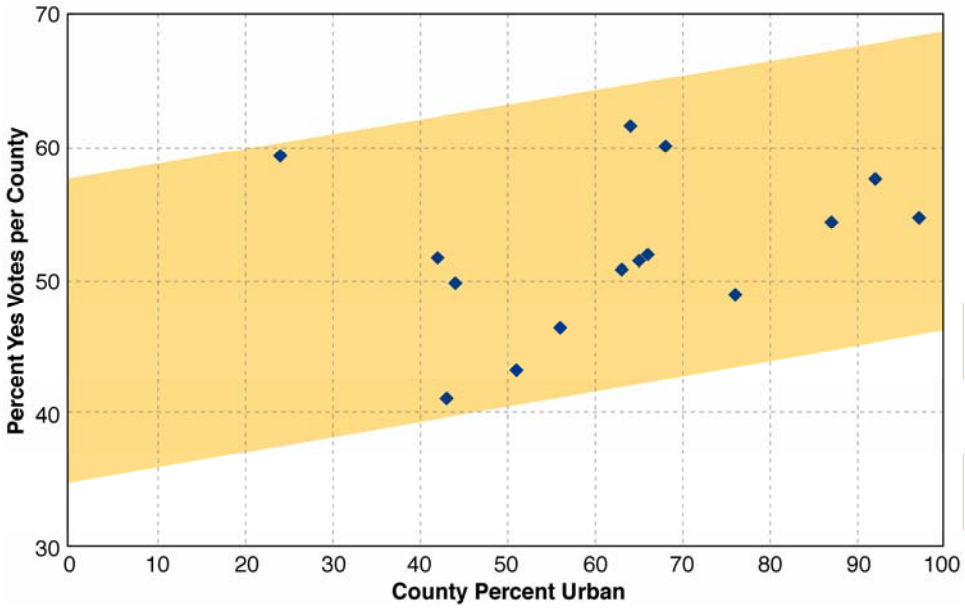

Figure 5.4: Scatter for Arizona county votes, November 2006.

There are three counties over 80 percent urban and all three voted yes. Even counties with 60 percent urban, nearly all percentages are over 50 percent yes. Between 40-60 percent urban, the yes percentages are nearly all under 50 percent. One unexpected result is that Apache County, which is only 24 percent urban returned a yes vote percentage of almost 59 percent. Apache County is long and narrow, spanning over half of the state's north-south extent along the Arizona-New Mexico border. With roughly 4,500 residents, the town of Eager is the largest in Apache County.

A correlation between percent yes votes and county percent urban in Nevada is clearly evident (adjusted r square = .344, p=.007 at 95 percent confidence). Nevada has three counties over 90 percent urban and all of them had yes vote percentages over 50 percent. Between 60-70 percent urban, results were mixed, with two counties voting yes and two voting no. Between 40-60 percent urban, all five counties voted no. Finally, between 0-10 percent urban, five counties voted no and one (Lincoln County) yes, but just barely (53 percent).

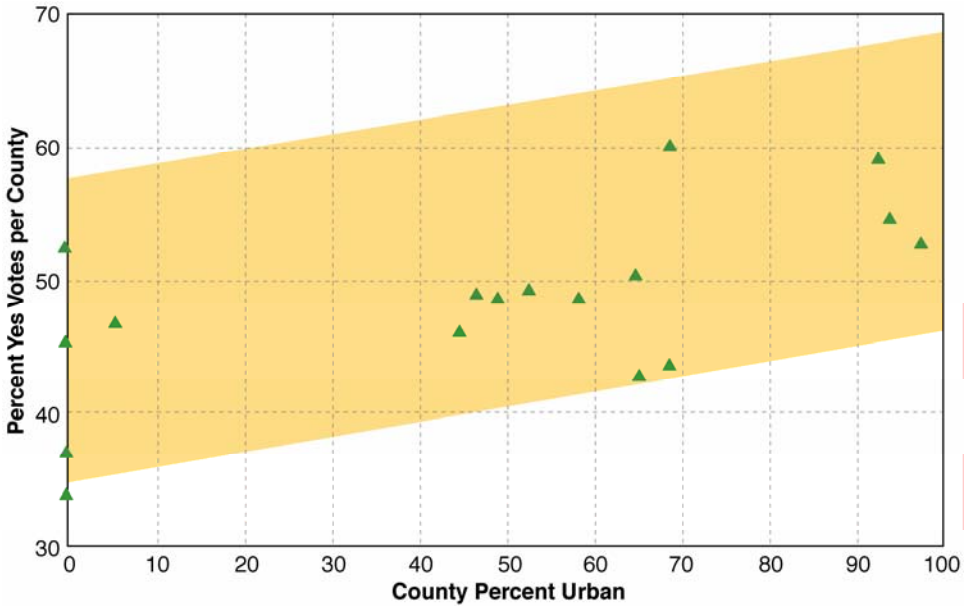

Figure 5.5: Scatter for Nevada county votes, November 2006.

With 88 counties, Ohio has a much larger number than either Arizona or Nevada. A positive correlation between the two variables is obvious (adjusted r square = .379; 95 percent confidence) in the Ohio data. There is one outlier: Delaware County is 69 percent urban and returned yes votes of 68 percent. This is a very favorable vote.

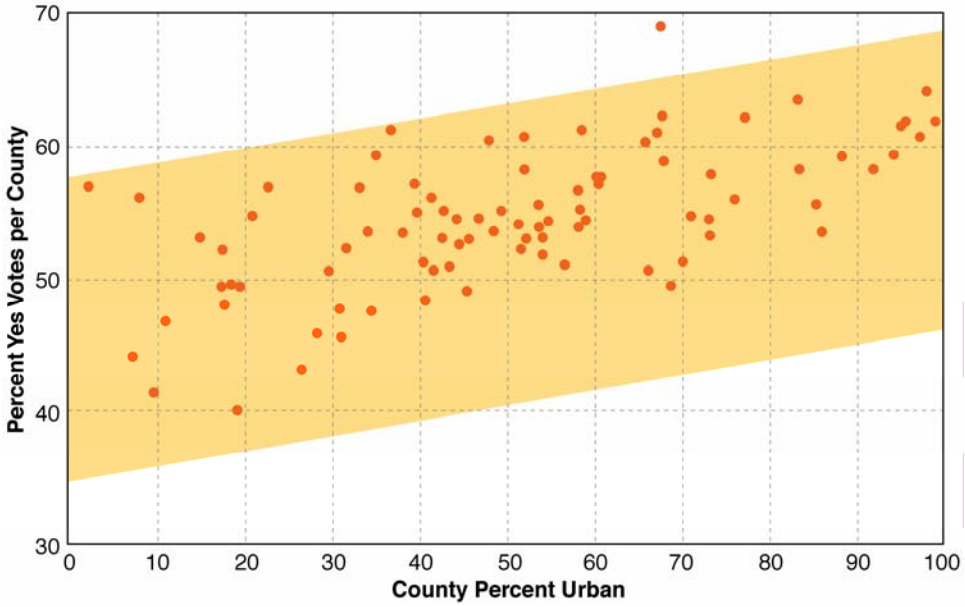

Figure 5.6: Scatter for Ohio county votes, November 2006.

A composite scatter clearly shows the positive correlation (Figure 5.7). With only one exception, all counties 70-100 percent urban returned yes votes.

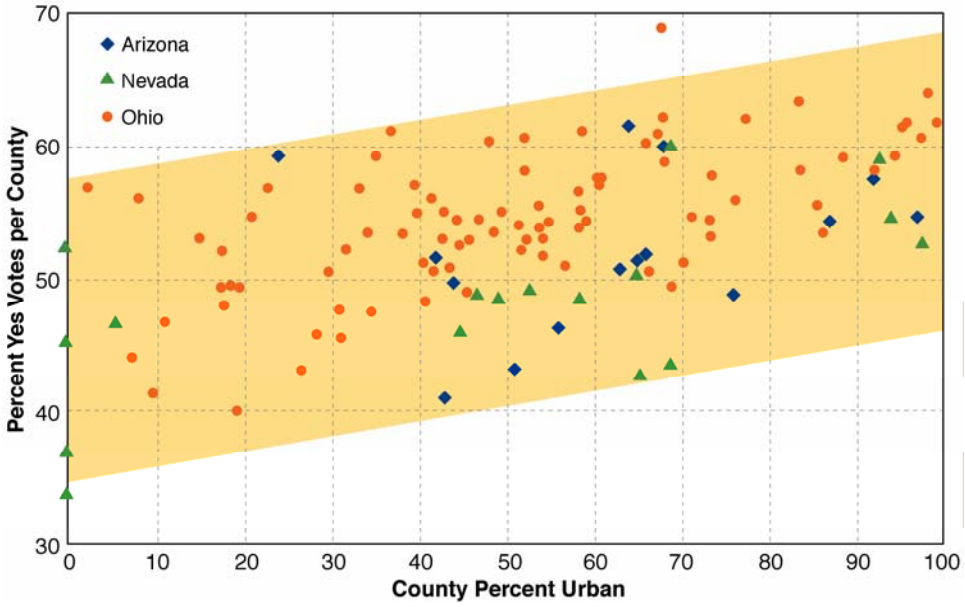

Figure 5.7: Composite scatter plot for Arizona, Nevada, and Ohio county votes, November 2006.

Results were mixed for counties between 20-70 percent urban, and between 0-20 percent urban, results were more often opposed to the initiative.

Comparing the composite with the three individual scatters shows that negative votes for counties under 20 percent urban are derived mainly from Nevada, but are supported by Ohio data. Data for the three individual states agree that counties over 80 percent urban always vote yes. The data between 20-80 percent are different among the states, but trend from a lower to higher percentage of yes votes. Because both Arizona and Nevada have few counties, the data for each of them are scarce. However, because the population structures of these two Western states are very different from that of Ohio, the combination forms a comprehensive dataset for analysis that can (hopefully) be useful in predicting outcomes of other state smoking ban initiatives. This theme will be explored in the upcoming chapter.

Hypothesis 2: The presence of local regulations assures a sufficient percentage of votes to pass a state initiative

The idea for this second hypothesis stemmed from two sources. One is the results of a November 2005 vote in which residents of the state of Washington voted on a measure to strengthen the state's existing public smoking ban. The percentage of yes votes for *every* county was at least 50 percent. The second is that research performed by Hahn, Rayens et al. (2006) shows that voter support in favor of smoking bans increases after the ban becomes effective. These two matters are discussed in turn below. Then I examine the three study states (Arizona, Nevada, Ohio) to see if they had any local regulations before the 2006 vote. I will next look into the corresponding county vote results for those communities to see if they returned favorable votes, that is, supporting the hypothesis that existing regulation assures a favorable vote.

The following map shows the percentage of yes votes in each county in Washington. As noted, every county returned votes of over 50 percent. The range of percentages for counties (n=39) in Washington was 52 percent (Columbia County) to 69 percent (San Juan County). Columbia County is in the southeast part of the state, whereas San Juan County is the largest island in Puget Sound, the northwest part of the state.

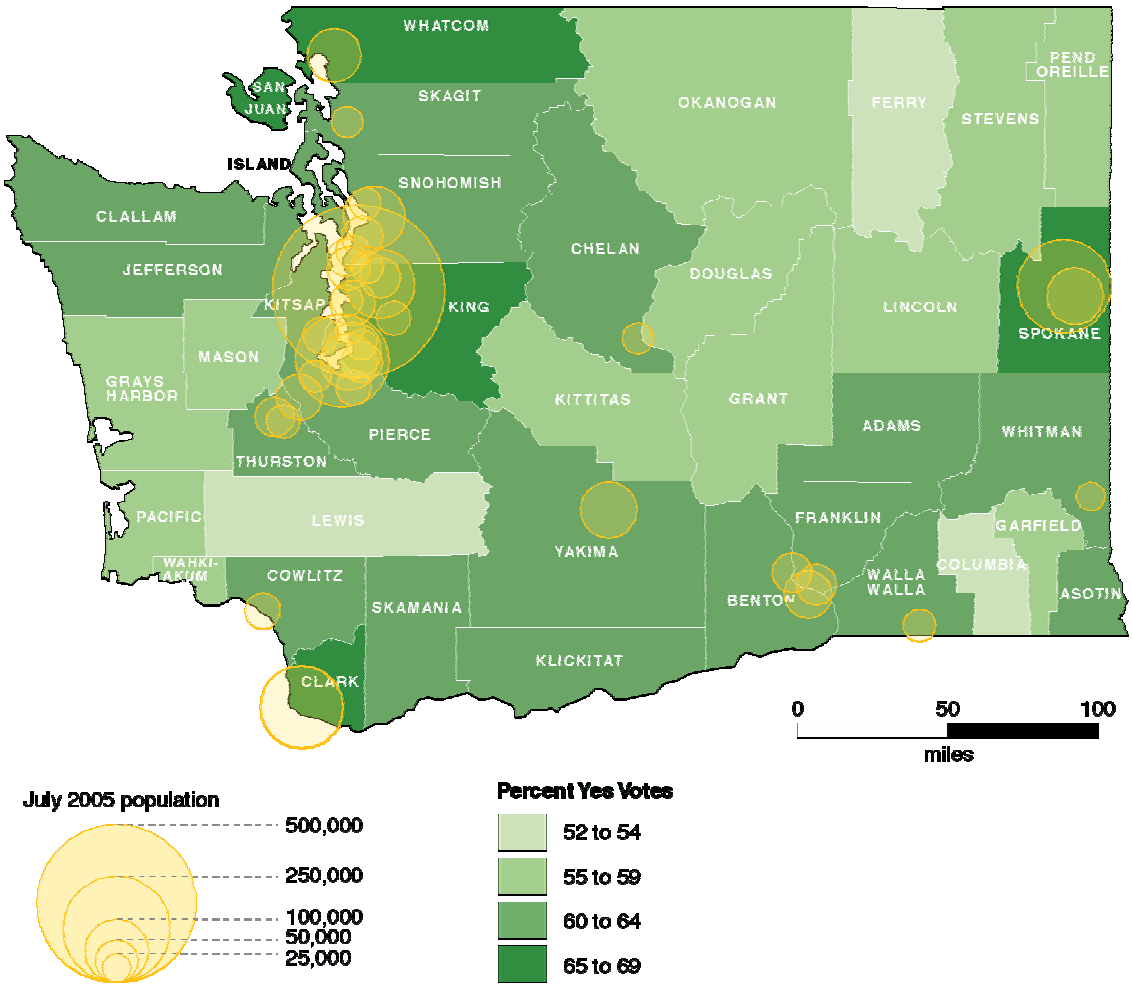

Figure 5.8: 2005 vote in favor of strengthening existing smoke-free law in Washington.

It is of interest that the relationship discussed in Hypothesis 1 is also evident here (adjusted r square = .135, p=.012; 95 percent confidence). The largest cities (in terms of population) in Washington are the capital, Seattle (King County), which has over 560,000 residents; Spokane and Tacoma, which have almost 200,000 residents each; Vancouver, which is just short of 150,000 residents; and Bellevue, which has approximately 110,000 residents. All five of these cities are located in counties with at least 60 percent of votes in favor of the 2005 initiative to strengthen Washington's smoking regulations.

Hahn, Rayens et al. (2006) performed a survey of Lexington, Kentucky residents (n=1091) in July and August of 2004 before the city's public smoking ban was implemented. They surveyed another group of residents (n=1055) six months after the

ban took effect. The results showed that "there was a *significant increase* in public support for the smoke-free law, from 56.7 percent pre-ordinance to 64 percent six months post-ordinance."

Five cities in Arizona had local smoking bans before the 2006 vote: Tempe, Guadalupe, Flagstaff, Prescott, and Sedona. Tempe and Guadalupe are both in Maricopa County and both their bans became effective in 2002. Flagstaff and Sedona are in Coconino County. The Flagstaff ban became effective in 2005 and the Sedona ban became effective in 2006. Prescott is in Yavapai County and the ban there became effective in 2005. In the 2006 state vote, at 62 percent, Coconino County had the highest percentage of votes in favor of the ban. Yavapai had 51 percent and Maricopa had 55 percent favorable votes. These three counties are neighbors that form a north/south line down the center of the state, and include the large Phoenix Metropolitan Statistical Area.

Nevada state law preempted local smoking regulations, so no local smoking regulations existed in Nevada before the 2006 vote.

Ohio had 12 local bans before the 2006 vote: Powell (Delaware County) had the first ban, which became effective in 2005. A smoking ban in Dublin, also in Delaware County, became effective in 2005. Among Ohio counties, Delaware had the highest percentage (69 percent) of votes in favor of the 2006 state smoking ban vote. In Franklin County, 8 communities had smoking bans: Upper Arlington and Columbus (effective 2004), Bexley, Grandview Heights, Worthington, Westerville, and New Albany (effective 2005), and Gahanna (effective 2006). In Franklin County, 64 percent of residents voted in favor of the Ohio state smoking ban initiative. Finally, Licking County, adjacent to Franklin County, had two communities with smoking bans, Heath and Granville, both of which became effective in 2006. In Licking County, 57 percent of residents voted in favor of the 2006 smoking ban initiative. Franklin County is home to Ohio's capital city, Columbus and Ohio State University, which is in the center of the state. Delaware County is its northern neighbor and Licking County is its eastern neighbor; thus forming a cluster of central Ohio counties with local smoking bans prior to 2006.

Although only 17 communities (5 in Arizona and 12 in Ohio) in this study had local regulations in advance of the 2006 vote, all 6 counties involved (3 in Arizona and 3

in Ohio) returned votes in favor of their state ban initiatives. Add these figures to the fact that in a 2005 vote in Washington, all 39 counties returned votes that favored strengthening its existing state regulations, and the fact that Hahn's 2003-2004 research showed an increase in preference for a smoking ban after it has become effective, all support the hypothesis that existing bans assure yes votes to subsequent bans. **Therefore, I accept my second hypothesis, viz., that existing smoking bans assure support for further bans.**

Having accepted these hypotheses, the next step is to project an outcome for a potential initiative in another state. In the following chapter, I project an outcome of a statewide vote on a smoking ban initiative in Kentucky.

CHAPTER 6: IMPLICATIONS FOR KENTUCKY

To create a projection to Kentucky, I first needed to establish class categories from the scatter plots. Counties 0-10 percent and 11-20 percent urban each have less than 50 percent likelihood of a yes vote. I grouped these together and considered them the lowest class for my choropleth map (i.e., counties less than or equal to 20 percent urban are hypothesized as unlikely to votes yes). Counties 21-30 percent, 31-40 percent, and 41-50 percent urban have likelihoods of 66 percent, 72 percent, and 66 percent, respectively. These formed the next-to-lowest category for the choropleth map, and to "err on the safe side," I used the lower percentage (66 percent) rather than the higher (72 percent). Counties 51-60 percent and 61-70 percent form the middle category at 80 percent likelihood. Counties 71-80 percent urban form the next-to-highest category at 87 percent, and counties 81-90 percent and 91-100 percent urban form the highest category at 100 percent likelihood of voting yes.

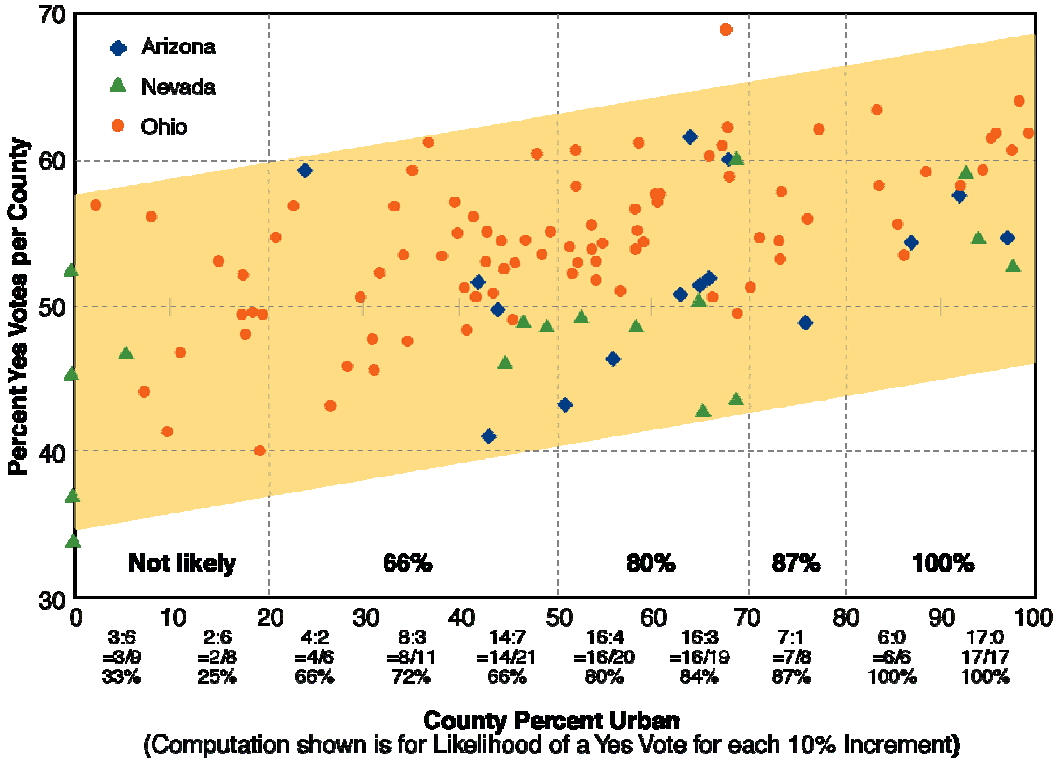

Figure 6.1. Scatter showing determination of percent likelihood of yes vote.

I then produced a spreadsheet (Figure 6.2, Appendix A) showing county name (Column A), county population (B), population that lives in an urban area (C), and county percent urban (D). I sorted the spreadsheet by the percent urban column (D) and made a new column (E) for likelihood of a yes vote. I filled this column in from the scatter plot categories above. Figure 6.3 is a map of the data in this column. Next, I multiplied each county's population (B) by its likelihood (E) and entered the result in the next column (F), which is the number of people in the county that are expected to vote yes. Column G is a duplicate of E and will be used to enter adjustments for counties with cities of >25,000 residents and counties with existing smoking bans. Column H shows the total number of people expected to vote in favor of a smoking ban in each county.

(A) County Name	(B) County Population	(C) Urban Population	(D) Percent Urban	(E) Likelihood of Voting Yes (from Scatter)	(F) Number of Yes Votes	(G) Adjusted Percent Likelihood of Voting Yes	(H) Adjusted Number Yes Votes (B*G)
Jefferson	693604	680799	0.98	100	693604	100	693604

Figure 6.2. Sample of spreadsheet in Appendix A.

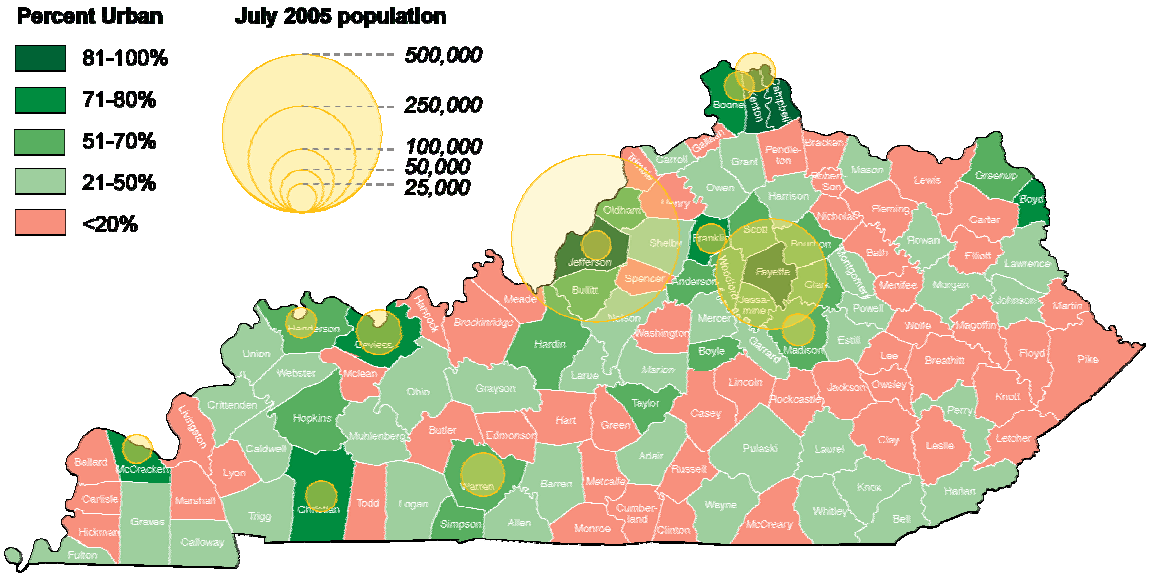

Figure 6.3. Percent likelihood of a yes vote for each Kentucky county based on county percent urban.

According to Hypothesis 1, cities with over 25,000 people are expected to vote in favor of a smoking ban. Therefore, I identified cities with over 25,000 people. Twelve cities met this criterion (see Figure 6.3):

1) Louisville-Jefferson County has over 550,000 residents
2) Lexington-Fayette County has over 260,000 residents
3) Owensboro (Daviess County) has 55,000 residents
4) Bowling Green (Warren County) has 52,000 residents
5) Covington (Kenton County) has 43,000 residents
6) Richmond (Madison County) has 31,000 residents
7) Hopkinsville (Christian County) has 29,000 residents
8) Frankfort (Franklin County)
9) Henderson (Henderson County) has about 27,000 residents
10) Paducah (McCracken County) has about 27,000 residents
11) Florence (Boone County) has about 26,000 residents
12) Jeffersontown (Jefferson County) has about 26,000 residents

Jefferson, Fayette, and Kenton counties were already at 100 percent likelihood of voting yes based on the percentage of population that lives in an urban area. Boone, Daviess, Franklin, Christian, and McCracken were at 87 percent and I changed them to 100 percent in Column G (adjusted percent likelihood). Warren, Henderson, and Madison were at 80 percent and I changed them to 100 percent in Column G.

According to Hypothesis 2, counties that contain cities with existing bans are expected to have favorable votes. The Kentucky Tobacco Policy Research Program website (www.mc.uky.edu/TobaccoPolicy/ordinances/smoke-free ordinances.htm) lists three counties and ten cities in Kentucky that already had smoking bans as of January 2007: Ashland (Boyd County), Daviess County, Elizabethtown (Hardin County), Frankfort (Franklin County), Georgetown (Scott County), Henderson (Henderson County), Letcher County, Lexington-Fayette County, Louisville-Jefferson County, Morehead (Rowan County), Oldham County, Paducah (McCracken County), Paintsville (Johnson County) (Figure 6.4). On their website, the program's mission is stated as "to reduce tobacco use and exposure to second-hand smoke through research, education, surveillance, and policy development in the treatment and prevention" of tobacco use.

The program has teams working on seven projects: Kentucky Center for Smokefree Policy, Differential Economic Impact of Smokefree Laws, Mental Health and Smoking During and After Pregnancy, Reducing Secondhand Tobacco Smoke: Cardiac and Asthma Outcomes, Smokefree Laws and Employee Turnover, Tobacco Prevention Community Partnerships, and Youth Access Laws and Social Sources of Tobacco. One of their research products is a guidebook entitled "Growing People: Building and Maintaining Coalitions for Tobacco Use Prevention and Cessation (2002).

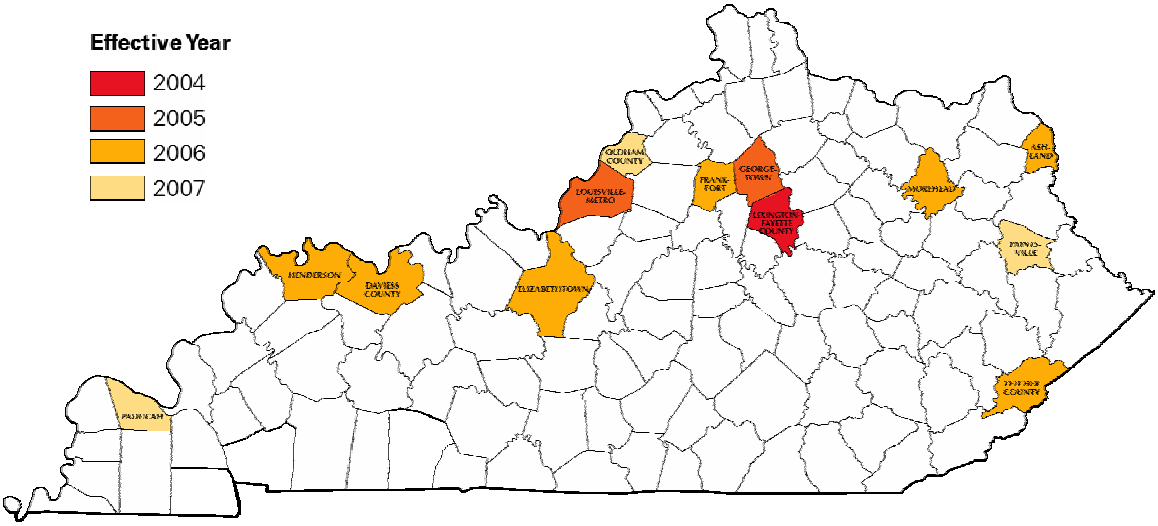

Figure 6.4. Smoke-free localities in Kentucky, as of January 2007.

Six of the locations that have smoking bans are cities with over 25,000 residents: Daviess County (Owensboro), Frankfort, Henderson, Lexington-Fayette County, Louisville-Jefferson County, and Paducah, so they were already listed as 100 percent likely to vote yes. Three locations were at 80 percent (Oldham, Hardin, and Scott) and two (Rowan and Johnson) were at 66 percent likelihood. I changed the likelihood of a yes vote for each of these five counties to 100 percent in Column G. A map of the final county projections is shown below (Figure 6.5).

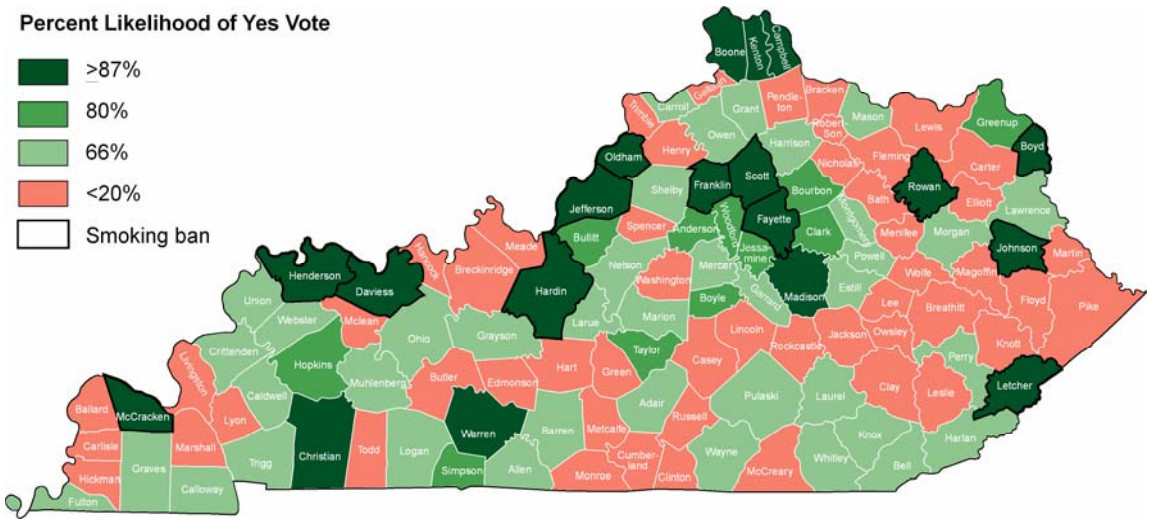

Figure 6.5. Projected Votes for Kentucky Counties.

Comparing Figures 6.3, 6.4, and 6.5 yields a couple of unexpected results. First, the three Northern Kentucky counties (Boone, Kenton, and Campbell) have high urban percentages, yet no smoking bans exist there at this time. It is possible that bans are under consideration in these counties. Figure 6.4 would have been enhanced by including information about counties that are considering smoking bans, however I was not able to locate this information. Likewise, I was unable to locate data for counties that have considered, but rejected bans. The other anomaly is that three of the counties in Eastern Kentucky (Rowan, Johnson, and Letcher) are among counties with the lowest percentage of urban residents, yet they have smoking bans. Rowan County is home to Morehead State University, which may have an influence on smoking policy, because the University would result in a higher education level among residents. Kentucky's other three state universities are Kentucky State University (Franklin County), University of Kentucky (Fayette County), and University of Louisville (Jefferson County), and all of these have smoking bans. Johnson and Letcher counties may have highly effective anti-smoking activist groups. Adding data on locations where activism exists would be another way to enhance Figure 6.4. Unfortunately, this information is not readily available.

Certainly, percent urban and presence of existing smoking regulations are not the only factors that are involved in a decision to vote for or against a smoking ban. Dixon, Lowery et al. (1991) showed that people who smoke are less likely to vote for smoking legislation, therefore smoking prevalence is one factor that would affect the outcome of a

ballot vote. Moon and Barnett (2003) identified ethnicity and poverty as factors that influence smoking prevalence in New Zealand, so these elements would, in turn, affect vote outcome. According to Nathanson (1996) government intervention (such as preemptive legislation) and level of anti-smoking activity would also play a role in a decision to vote for or against a smoking ban. Finally, Ross and Taylor (1998) noted that both economic dependence on tobacco and attitude toward smoking affect smoking prevalence.

As mentioned in Chapter 3, 98% of Kentucky counties produce tobacco, yielding 70% of all Burley tobacco for cigarettes. Therefore, economic dependence on tobacco is a factor that may influence adoption of smoking bans in Kentucky. Figure 6.6 shows each county's tobacco acreage as a percent of all harvested cropland. This provides a measure of each county's economic dependence on tobacco as a cash crop. If there is an association between economic dependence on tobacco and smoking bans, one would expect smoking bans *not* to exist in any of the darkest shaded counties. At least two counties (Fayette and Johnson) unexpectedly have bans. While Fayette County's ban could be explained by its high urban population percentage or high education level, there is no apparent reason for Johnson County's ban. This map, however, may explain why many of the counties in Eastern Kentucky—especially the 5 darkest shaded counties—have no bans.

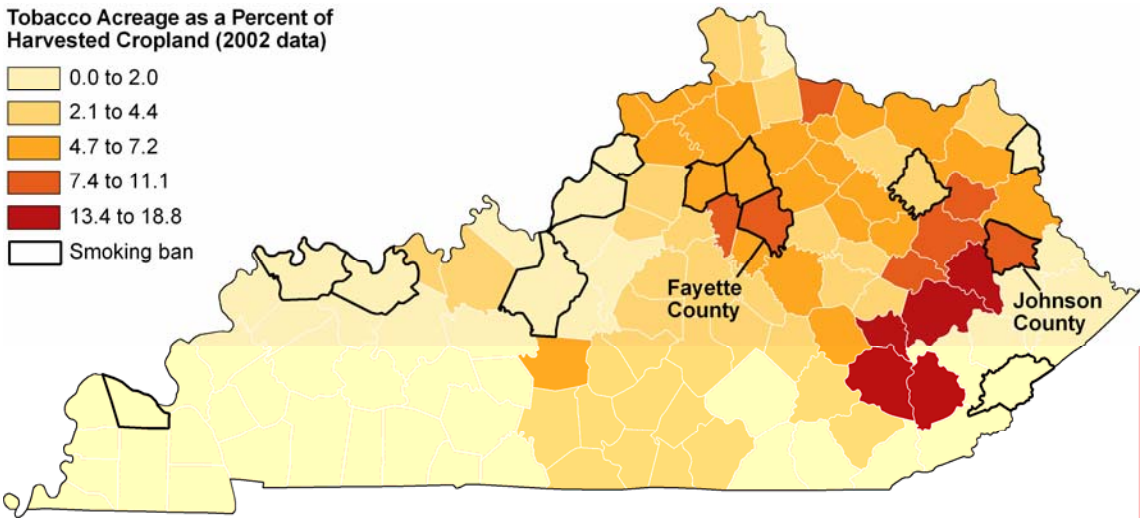

Figure 6.6. County economic dependence on tobacco (U.S. Census Bureau, 2002).

Chapter Summary

In this chapter I have used Kentucky as a case study to show how the results of a smoking ban initiative vote may be projected using the method developed in this research. I have provided maps that show the likelihood of Kentucky counties to vote in favor of a smoking ban based on percentage of population that lives in an urban area (Figure 6.3), the location of smoking bans in Kentucky to date (2007) (Figure 6.4), projected smoking ban votes for Kentucky counties (Figure 6.5), and economic dependence on tobacco (Figure 6.6).

CHAPTER 7: CONCLUSIONS

The habit of cigarette smoking dates to colonial America and gained popularity in large part through American involvement in at least three major wars (Civil War, WWI, and WWII) (Ravenholt 2006) and the advent of television (U.S. Department of Health and Human Services 2000). Cigarette smoking peaked in 1964 and began declining with the publication of the Surgeon General's Report on Smoking and Health, which causally linked smoking to lung cancer. Further studies showed that smoking causes cardiovascular disease, stroke, and other cancers in smokers, as well as in non-smokers who breathe cigarette smoke second-hand. Despite the results of these studies, cigarettes remain a legal product and Americans continue to smoke. One reason that cigarette smoking remains a problem may be that it is difficult to say exactly how much tobacco smoke contributes to these diseases. For example, not all smokers develop lung cancer, and not all lung cancer is caused by smoking. Another reason stems from mixed messages presented to the public. In contradiction to medical study results, messages sent by the tobacco industry implied that smoking is not such a harmful habit. The industry eventually admitted to lying to the public about the safety of tobacco products and manipulating the quantity of nicotine in cigarettes to facilitation addiction. This admission occurred in 1994 during testimony in a lawsuit brought against the industry. The "truth" about smoking opened a window of opportunity for activists to promote laws against public smoking.

Today, cigarette smoking is the cause of more than 430,000 deaths each year in the U.S. alone. Much of the expense of caring for sick smokers falls upon the government, which provides medical care through Medicaid. To combat the problem, the federal government has increased taxes, restricted advertising, and restricted access to minors. State governments have also implemented taxes and many have restricted smoking in workplaces, restaurants, and bars in an effort to protect non-smokers. Unfortunately, some state laws prevent stricter local laws from being implemented in places where they are desired.

In most cases, city or state legislators decide on whether smoking laws should be implemented, what provisions they should contain, and how strict they should be. Of late,

however, there is support for the idea that public vote may be a better way of making these decisions. Three states (Arizona, Nevada, and Ohio) included ballot initiatives for state smoking bans with their 2006 Primary Elections. All three states passed the initiatives.

Research Summary

This research examined county-level data from the smoking ban initiatives in Arizona, Nevada, and Ohio, with a goal of developing a method for predicting future vote results in other states. The examination of data led to formulation of two hypotheses. Hypothesis 1 was that a positive relationship exists between city size and percentage of county residents who vote in favor of a statewide smoking ban. That hypothesis was accepted and in order to perform further analyses a revised Hypothesis 1 was formulated: There is a positive relationship between the percentage of a county's residents who vote in favor of a state smoking ban and the percentage of a county's residents that lives in an urban area. This stands to reason because urbanness conflates with other factors that have been shown to be associated with smoking prevalence, such as higher education and income levels.

Hypothesis 2 was that the presence of local regulations assures a sufficient percentage of votes to pass a state initiative. This hypothesis is grounded in research by the Kentucky Tobacco Research Policy Program, which showed an increase in support for smoking bans after they had been implemented. This hypothesis is also supported by the 2005 Washington vote to strengthen existing smoking policy. Hypothesis 2 was accepted.

Finally, a case study was presented. A map of projected county votes was produced and the outcome of a potential Kentucky vote was predicted to be favorable.

Study Limitations

Three limitations of this study should be noted. One limitation is making a prediction for Kentucky based on data from states that are very different from it culturally, politically, and geographically. Arizona and Nevada are Western states with large counties and they have sparse populations with a few clustered high-density urban

areas. Kentucky on the other hand, is a Midwestern/Southern Border state with many small counties and a generally scattered rural population. Ohio is more similar to Kentucky in its geographical location, culture, and county structure. Ohio is, however, more populous than Kentucky, has more urban areas, and tends toward industry rather than agriculture as a predominant lifeway. Kentucky is more akin to North Carolina, another major tobacco producing state, than to Arizona, Nevada, or Ohio. Because North Carolina is similar to Kentucky in terms of economic dependence on tobacco, it would be interesting to compare the map of projected Kentucky votes with a map of projected votes for North Carolina counties. This could be a topic for a follow-up study.

A second limitation is using county level data. Census tract data would provide a more detailed investigation. A third limitation is using total population as a measure of voters. This measure assumes that every person in the county will vote, while in reality not all residents are eligible to vote. Some residents are minors; others simply choose not to vote. For the purposes of this study, I assume that these data provide a representative sample of the population that will vote.

Contribution

While many studies have been performed in regard to smoking and health, there has been no method devised to predict the percentage of voters that might support smoking legislation. This research has developed such a methodology based on a measure of county urbanness and presence of existing smoking bans. The methodology may be used to identify states that have a high likelihood of passing a smoking ban. Once identified, these states could be targeted for smoke-free ballot initiatives. In addition, the same methodology may identify states or counties with a low likelihood of passing a state ban. Activists could, with this knowledge, direct anti-smoking campaign efforts to those locations. In this way, cartographic and geographic analyses may be able to facilitate the passage of smoke-free policy.

Whereas education, race, socio-economic standing, ethnicity, etc. are important factors in determining whether an individual may choose to smoke, looking at the topic of smoking bans visually, in the form of maps, reveals that *place* of residence—urban

versus rural—may be an important element in whether or not communities choose to adopt smoking bans. This study is unique in its visual approach.

Future Directions

Beyond this study, future research could be directed at other spatial factors that are potentially involved in decisions to vote for or against smoking policy. One example that was commented upon in this study is proximity to colleges and universities. Another direction for a future study would be to explore the idea that smoking bans diffuse from county to county. The Central Kentucky counties in Figure 6.4 suggest that this is a possibility. Yet another direction would be to look at whether subsequent voter support for smoking bans is affected by how the ban was initiated—legislative or popular vote.

Appendix A. Computation for Likelihood of County Votes to be Favorable							
(A) County Name	(B) County Population	(C) Urban Population	(D) Percent Urban	(E) Likelihood of Voting Yes (from Scatter)	(F) Number of Yes Votes	(G) Adjusted Percent Likelihood of Voting Yes	(H) Adjusted Number Yes Votes (B*G)
Jefferson	693604	680799	0.98	100	693604	100	693604
Fayette	260512	249378	0.96	100	260512	100	260512
Kenton	151464	140308	0.93	100	151464	100	151464
Campbell	88616	74693	0.84	100	88616	100	88616
Boone	85991	64744	0.75	87	74812	87	74812
Boyd	49752	36988	0.74	87	43284	87	43284
Daviess	91545	67557	0.74	87	79644	100	91545
Franklin	47687	35077	0.74	87	41488	100	47687
Christian	72265	52471	0.73	87	62871	100	72265
McCracken	65514	46790	0.71	87	56997	100	65514
Jessamine	39041	27108	0.69	80	31233	80	31233
Clark	33144	22085	0.67	80	26515	80	26515
Oldham	46178	30121	0.65	80	36942	80	36942
Bullitt	61236	39539	0.65	80	48989	80	48989
Hardin	94174	60007	0.64	80	75339	80	75339
Boyle	27697	17502	0.63	80	22158	80	22158
Warren	92522	58249	0.63	80	74018	100	92522
Greenup	36891	22630	0.61	80	29513	80	29513
Henderson	44829	26521	0.59	80	35863	100	44829
Woodford	23208	13641	0.59	80	18566	80	18566
Madison	70872	41554	0.59	80	56698	100	70872
Scott	33061	19030	0.58	80	26449	80	26449
Simpson	16405	9087	0.55	80	13124	80	13124
Bourbon	19360	10619	0.55	80	15488	80	15488
Hopkins	46519	25205	0.54	80	37215	80	37215
Anderson	19111	9726	0.51	80	15289	80	15289
Taylor	22927	11649	0.51	80	18342	80	18342
Mason	16800	8322	0.50	66	11088	66	11088
Carroll	10155	4977	0.49	66	6702	66	6702
Caldwell	13060	6347	0.49	66	8620	66	8620
Harlan	33202	15829	0.48	66	21913	66	21913
Calloway	34177	16253	0.48	66	22557	66	22557
Montgomery	22554	10152	0.45	66	14886	66	14886

Appendix A. Computation for Likelihood of County Votes to be Favorable (continued)							
(A) County Name	(B) County Population	(C) Urban Population	(D) Percent Urban	(E) Likelihood of Voting Yes (from Scatter)	(F) Number of Yes Votes	(G) Adjusted Percent Likelihood of Voting Yes	(H) Adjusted Number Yes Votes (B*G)
Mercer	20817	8436	0.41	66	13739	66	13739
Shelby	33337	13291	0.40	66	22002	66	22002
Pulaski	56217	22211	0.40	66	37103	66	37103
Whitley	35865	13467	0.38	66	23671	66	23671
Nelson	37477	14033	0.37	66	24735	66	24735
Bell	30060	11118	0.37	66	19840	66	19840
Fulton	7752	2805	0.36	66	5116	66	5116
Harrison	17983	6494	0.36	66	11869	66	11869
Barren	38033	13638	0.36	66	25102	66	25102
Union	15637	5513	0.35	66	10320	66	10320
Laurel	52715	17127	0.32	66	34792	66	34792
Muhlenberg	31839	10201	0.32	66	21014	66	21014
Wayne	19923	6198	0.31	66	13149	66	13149
Rowan	22094	6702	0.30	66	14582	66	14582
Graves	37028	11199	0.30	66	24438	66	24438
Marion	18212	5503	0.30	66	12020	66	12020
Crittenden	9384	2773	0.30	66	6193	66	6193
Knox	31795	9372	0.29	66	20985	66	20985
Estill	15307	4205	0.27	66	10103	66	10103
Garrard	14792	3953	0.27	66	9763	66	9763
Johnson	23445	5978	0.25	66	15474	66	15474
Adair	17244	4374	0.25	66	11381	66	11381
Logan	26573	6690	0.25	66	17538	66	17538
Ohio	22916	5749	0.25	66	15125	66	15125
Powell	13237	3133	0.24	66	8736	66	8736
Larue	13373	3112	0.23	66	8826	66	8826
Allen	17800	4018	0.23	66	11748	66	11748
Grayson	24053	5419	0.23	66	15875	66	15875
Grant	22384	4962	0.22	66	14773	66	14773
Lawrence	15569	3423	0.22	66	10276	66	10276
Perry	29390	6431	0.22	66	19397	66	19397
Webster	14120	3001	0.21	66	9319	66	9319
Trigg	12597	2653	0.21	66	8314	66	8314
Morgan	13948	2888	0.21	66	9206	66	9206

Appendix A. Computation for Likelihood of County Votes to be Favorable (continued)							
(A) County Name	(B) County Population	(C) Urban Population	(D) Percent Urban	(E) Likelihood of Voting Yes (from Scatter)	(F) Number of Yes Votes	(G) Adjusted Percent Likelihood of Voting Yes	(H) Adjusted Number Yes Votes (B*G)
Fleming	13792	2816	0.20	0	0	0	0
Breathitt	16100	3279	0.20	0	0	0	0
Lincoln	23361	4573	0.20	0	0	0	0
Clay	24556	4687	0.19	0	0	0	0
Carter	26889	4783	0.18	0	0	0	0
Rockcastle	16582	2819	0.17	0	0	0	0
Meade	26349	4419	0.17	0	0	0	0
Marshall	30125	4196	0.14	0	0	0	0
Hart	17445	2230	0.13	0	0	0	0
Floyd	42441	5318	0.13	0	0	0	0
Hancock	8392	919	0.11	0	0	0	0
Pike	68736	6346	0.09	0	0	0	0
Trimble	8125	476	0.06	0	0	0	0
Letcher	25277	78	0.00	0	0	0	0
Ballard	8286	0	0.00	0	0	0	0
Bath	11085	0	0.00	0	0	0	0
Bracken	8279	0	0.00	0	0	0	0
Breckinridge	18648	0	0.00	0	0	0	0
Butler	13010	0	0.00	0	0	0	0
Carlisle	5351	0	0.00	0	0	0	0
Casey	15447	0	0.00	0	0	0	0
Clinton	9634	0	0.00	0	0	0	0
Cumberland	7147	0	0.00	0	0	0	0
Edmonson	11644	0	0.00	0	0	0	0
Elliott	6748	0	0.00	0	0	0	0
Gallatin	7870	0	0.00	0	0	0	0
Green	11518	0	0.00	0	0	0	0
Henry	15060	0	0.00	0	0	0	0
Hickman	5262	0	0.00	0	0	0	0
Jackson	13495	0	0.00	0	0	0	0
Knott	17649	0	0.00	0	0	0	0
Lee	7916	0	0.00	0	0	0	0
Leslie	12401	0	0.00	0	0	0	0
Lewis	14092	0	0.00	0	0	0	0

Appendix A. Computation for Likelihood of County Votes to be Favorable (continued)							
(A) County Name	(B) County Population	(C) Urban Population	(D) Percent Urban	(E) Likelihood of Voting Yes (from Scatter)	(F) Number of Yes Votes	(G) Adjusted Percent Likelihood of Voting Yes	(H) Adjusted Number Yes Votes (B*G)
Livingston	9804	0	0.00	0	0	0	0
Lyon	8080	0	0.00	0	0	0	0
Magoffin	13332	0	0.00	0	0	0	0
Martin	12578	0	0.00	0	0	0	0
McCreary	17080	0	0.00	0	0	0	0
McLean	9938	0	0.00	0	0	0	0
Menifee	6556	0	0.00	0	0	0	0
Metcalfe	10037	0	0.00	0	0	0	0
Monroe	11756	0	0.00	0	0	0	0
Nicholas	6813	0	0.00	0	0	0	0
Owen	10547	0	0.00	0	0	0	0
Owsley	4858	0	0.00	0	0	0	0
Pendleton	14390	0	0.00	0	0	0	0
Robertson	2266	0	0.00	0	0	0	0
Russell	16315	0	0.00	0	0	0	0
Spencer	11766	0	0.00	0	0	0	0
Todd	11971	0	0.00	0	0	0	0
Washington	10916	0	0.00	0	0	0	0
Wolfe	7065	0	0.00	0	0	0	0
KENTUCKY	4041769	2251967	0.56		2757322		2834978
PERCENT LIKELIHOOD OF PASSING A SMOKING BAN		**55.72**			**68.22**		**0.70**

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VITA

Donna Arlene Gilbreath

Date and place of birth: December 23, 1964; Mt. Olivet, Kentucky

Degrees: University of Kentucky, Bachelor of Arts-Geography, 1992

Professional positions:

Editor, University of Kentucky, Cardiology Division, Lexington, KY 2004-Present

Freelance Cartography and Graphic Design, Lexington, KY 1993-Present

Cartographer, University of Kentucky, Program for Archaeological Research, Lexington, KY 2000-2004

Information Specialist, University of Kentucky, College of Engineering, Lexington, KY 1997-1998

Cartographic Editor, Photo Science, Lexington, KY 1993-1995

Staff Assistant, National Geographic Society, Washington, DC 1991-1992

Staff Assistant, University of Kentucky, Office of International Affairs, 1988-1991

Staff Assistant, University of Kentucky, Electrical Engineering, 1987-1988

Staff Assistant, University of Kentucky, College of Law, 1985-1987

Signature: _____
Donna A. Gilbreath